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ELECTRICAL REVIEW.

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THE I.E.E. COUNCIL NOMINATIONS.

THE list of members nominated by the Council of the Institution of Electrical Engineers for the vacancies on the Council which will occur next September is of exceptional interest.

In view of the setting-up of the Ministry of Ways and Communications, the selection of Mr. Roger T. Smith for the office of President is timely and appropriate. It means that the Government, in considering the measures by which the service given by the railways can be improved, and the running costs reduced, will have available, with the full authority of the highest position the profession can bestow, a qualified and experienced railway engineer. Whether the Government will take full, or any, advantage of the opportunity of consultation so afforded remains to be seen, but we may at least hope it will do so.

Mr. Chattock and Mr. Woodhouse retire from the office of vice-president, and Mr. Woodhouse is nominated to serve again. We regret the disappearance (temporary, we hope) of Mr. Chattock, but we suppose it likely that the course adopted has his approval. Mr. Ll. B. Atkinson is nominated for the other vacancy, and this will introduce a welcome diversity into the complexion of that particular section of the Council.

We have before remarked that the consequences of the explosive advent of Mr. H. Faraday Proctor, some years ago, have been unexpectedly far-reaching. When he was nominated, from outside, the Council contained no representative of the electric supply engineers. At the present moment all four of the vice-presidents are central-station men.

For the three vacancies in the Council among the rank of Members, seven names are put up; for the three Associate Members, three names; and two for the two Associates.

Dr. W. H. Eccles, who succeeded the late Prof. Silvanus P. Thompson as Professor of Physics at the Finsbury Technical College, is a renowned scientist, and a capable administrator. Mr. Fedden, of Sheffield, has only recently become a member of the Institution, but it has long been recognised as desirable that he should become one, and his record is such as to assure us that, if he secures election, he will do useful work. Mr. Welbourn would add one more to the scanty numbers of the representatives of the manufacturing interests. The firm with which he is connected, the British Insulated and Helsby Cables, Ltd., is at present represented by Mr. G. H. Nisbett, who retires on September 30th next.

Three representatives of the class of Associate Member are nominated, in the persons of Mr. H. J. Cash, President of the Electrical Contractors' Association; Mr. J. R. Cowie, one of Mr. Lackie's young men, and Mr. E. A. Gatehouse, of the B.T.H. Co., in whose nomination a sign of the times may be discovered by the discerning. We think it safe to prophesy that more of this class will be nominated. We hope we shall be justified in reading into the nominations of new and, perhaps, somewhat unexpected men, an indication that fresh life is about to pulsate through the veins of the Institution. The list of papers to be read, which was lately circulated, is decidedly more attractive and covers a wider ground than has been the case for several years, and interesting discussions ought to be provoked.

Now that Mr. Wordingham is approaching the end of his second year of office, we take the opportunity of again expressing the view we put forward three years ago—that the President should, save in the most exceptional circumstances, hold office for one year only.

That is also the view of Mr. Wordingham himself, as we pointed out last year; but we did not then raise any objection to his re-election, because, in our opinion, the exceptional conditions which justified it were fulfilled—he

had put forward a lengthy programme of reforms, and had been so successful in attaining the realisation of some of them that we thought it highly desirable that he should be enabled to continue the good work. Our opinion has been amply vindicated by the further crop of useful innovations for which he has been largely responsible during the past year, to which we hope many others will be added during the remainder of the session. Let it not be forgotten that Mr. Wordingham was the author of that epoch-making declaration of policy to which we would have every President-Elect subscribe: "*I do not think there is any matter affecting the electrical industry which is not the business of the Institution*"—a priceless saying.

The forward movement in the engineering institutions in general is at all times exceedingly slow, and we cannot afford to let slip any source of motive power for the sake of conforming to a rule; but the exception and the rule have become interchanged, and, in our opinion, it is time to restore the normal state.

With new blood on the Council, and the representation of up-to-date ideas regarding the conditions in the profession and industry, it may well be that the time is appreciably nearer when every electrical engineer will be able to look to the Institution as his guiding star, and to obtain therefrom inspiration which will enable him at once to carve out his own career successfully and to advance the prosperity of the country.

GERMAN INDUSTRY ON THE ROAD TO RUIN.

A remarkable statement has just been made on behalf of the Siemens-Schuckert Co. in order to inform the workmen and staff and the industry in general of the economic prospects of the undertaking, so as to induce the labour interests, if possible, not to allow this great concern to go to ruin, together with themselves as employés. The statement, which is made by Herr C. F. von Siemens, and is addressed to the men who returned from the front, is also specially noteworthy from the fact that it throws light on the work carried out by the company during the war, and also on the capital held in countries not allied with Germany.

The statement first deals with the work accomplished during hostilities. It is mentioned, for instance, that, apart from having embarked upon the manufacture of fuses, arms, and shells, the company was engaged to an increased extent in its own particular branches. These comprised the construction of wireless stations, the extension of the company's high-speed telegraph system, the improvement of the method of transmitting orders on ships, the technics of U-boats, of which 97 per cent. were equipped on the Schuckert system (electrical control); the development of substitute materials (zinc, iron, in replacement of copper, substitutes for rubber and gutta-percha, and the production of nitrogen); experiments with new and gigantic aeroplanes of a size hitherto unknown, and the construction of a faultless rotary motor having an efficiency superior for its weight to that of all others. Coming to the question of the turnover, it is stated that 70 per cent. of the value in 1917 consisted of electrical manufactures and only 30 per cent. of non-electrical war material. The number of workmen increased during the war from 57,357 to 64,124. During the four years the voluntary payments made on behalf of the workmen and staff amounted, on the rough pre-war conversion basis of 20 marks to the pound sterling, to £3,500,000, whilst the wages, salaries, and war bonuses reached £28,000,000 in the same period of years. On the other hand, the profits allocated to the shareholders and partners only totalled £2,625,000. The value of the turnover advanced from £25,000,000 in 1913 to £42,500,000 in 1918. The amount formerly paid for coal in Siemenstadt was £75,000; it is now £275,000; for gas it was £27,500, as compared with £75,000 at present; whilst the prices paid for copper and dynamo iron are now five times greater than formerly, tin and oil are ten times higher, and insulating material is 50 times greater in cost than previously.

The statement then raises the question of the capital which the Siemens-Schuckert group already had invested in hostile countries prior to the war. According to Herr C. F. von Siemens, the capital amounted to £6,150,000, and how much of this can be recovered cannot be seen at the present time. In Russia alone it is probably certain that a sum of £2,250,000 is lost; the number of workers there has declined from 5,000 to 100, "notwithstanding the most strict laws for the maintenance of working and against dismissals." On the other hand, an amount of £1,700,000 was invested in England, and this had been expropriated. The value had been deposited with the English Government, and it was to be hoped that it would not be set against English demands. In that event it appeared to be more than questionable whether compensation could be obtained from the German Government. The sum invested in the works in France was £350,000, and this ceased to be operative a long time ago, as the machinery had been removed and the buildings served the purpose of storage sheds. In addition to these cases, there were also losses in Italy, Portugal, Rumania, and all other enemy countries.

The present situation of the works, it is declared, is such that the deliveries of manufactures have very considerably declined. As compared with the average monthly output in the year 1917-18, the production in October, 1918, receded by 13 per cent.; and in November, by 40 per cent. It is submitted that neutral countries are deterred from placing orders with the Siemens-Schuckert group through this diminution in efficiency, the doubt concerning labour conditions, and the consequential lack of certainty respecting the time of delivery; and, as an instance, mention is made of the loss of an order for Denmark, although the price quoted was lower than that of neutral competitors. If a disposition and readiness to work did not soon return, Herr von Siemens remarked, all of them would be ruined, especially as they would have to reckon with much keener competition on the part of England, as well as of neutral industries which had been strengthened during the war.

Important Exhibition at Athens.

In view of the known scarcity of every kind of manufactured article in Greece and the neighbouring markets, solid business ought to result to firms who make an adequate representation at the forthcoming exhibition in Athens of British manufactures. The exhibition is the outcome of the visit paid to this country last autumn by a number of Greek business men, and of the subsequent examination of the trading position in Greece which was made by the commercial representative there of the Federation of British Industries (Major E. Kennard). It is to be of the type which ought to appeal to the British manufacturer, who is accused, with some justification, of being at times too prone to hesitate at any expenditure until he can see an immediate and highly profitable return. It is to be a purely *selling* exhibition. In Major Kennard's opinion, every exhibitor who can guarantee immediate, or at all events quick, delivery in bulk to the samples which he exhibits, will not only pay his expenses, but will make a very large and immediate profit, without undue expense or risk. It is hoped to attract traders from Turkey, the Balkans, and Asia Minor. In all these countries there is great scope for electrical and other engineering enterprise. In Greece itself the proposed commercial development of the military railway between Piræus and Salonica gives promise of new industrial activities, with their resultant openings for British trade. The country is said to possess 66,000 H.P. in water-power, only just over 6,000 H.P. of which has yet been utilised. There is talk of many new lines of manufacture and much extension of existing lines in Piræus, Salonica, and other industrial centres, particularly in the direction of shipbuilding. Altogether the opportunity looks

an exceedingly favourable one. The demand for goods is wide and insistent, the customer is favourably disposed towards the British supplier, the money is there all right, and the Federation shows an easy way of getting the business through the medium of its exhibition.

The Greek Government has lent for the purpose the "Zappeion" building, close to the centre of Athens, and nearly a third of the available space was taken up within four weeks of applications being invited. It is said that nearly all the most important branches of British manufacture are represented already. However, an annexe is being constructed on land adjoining the Zappeion—also lent by the Government—where the larger exhibits can be housed. There seems an excellent chance of making Greece a stepping-stone to the trade of the Balkans and Levant.

National Electricity Supply.

An important addition to the numerous reports on the national scheme is summarised on p. 425 of this issue. It embodies the opinions of the chairmen of the Sections of the Advisory Council to the Ministry of Reconstruction, and deals with the administrative aspect of the subject. It is interesting to note that not one of the chairmen, so far as we know, is associated with electricity supply in this country, though the three titled gentlemen are closely connected with electrical undertakings abroad.

The main question that was submitted to them was "whether electric power should be generated on a national system," and if so, under what conditions. The reference might have been more intelligibly framed, but apparently the chairmen understood it, for they unhesitatingly answered in the affirmative, though they found fault with the system of administration recommended by the Board of Trade Committee on Electric Power Supply. Sir Clarendon Hyde dissented from the principle of compulsory purchase of existing undertakings, and Mr. W. L. Hichens fundamentally disagreed with the report.

The chairmen, all noted men of business, recommended a national unified system under State regulation, and largely financed by the State; and we are very glad to see that they add that it should be framed and administered on a commercial basis, not upon Civil Service lines. This is a matter of the very first importance. As we all know only too well, the telegraph system in Government hands was established on Civil Service lines, with unfortunate results from the point of view of profit and loss; it is controlled nominally by a Member of Parliament, but actually by a permanent Secretary, and the engineering department, with a technical staff of first-class quality and undoubted efficiency, is subordinated to an executive of purely clerical character, so that even the Engineer-in-Chief himself can perform no administrative act on his own authority. Now the telephones have been incorporated in the same paralysing system, with the inevitable result that by degrees all initiative will be dried up and we shall follow in the wake of other nations where we used at least to hold our own. Above all, let the national electricity supply system be preserved from such a fate!

The chairmen agreed that generating plant and main transmission lines should be nationalised, but that distribution might be left in the hands of existing agencies; they would enlarge the Electricity Board to six members, and give it full authority, while the schemes which it devised would be carried out by an "Operating Executive." It is fairly safe to surmise that the Electricity Bill which is so eagerly awaited will be cast on some such lines, and to our mind the suggestions of the Council make for efficiency and celerity, leaving the Board free to deal with the broad principles while the Executive translates them into practice. The urgency of the matter is emphasised in the report—but it has been emphasised for many months; when will the machine begin to move?

Since writing the foregoing we learn that by an amendment in Committee the control of electricity supply has been withdrawn from the Transport Bill.

ELECTRICAL ENGINEERING RECONSTRUCTION: THE RIGHT MEN IN THE RIGHT PLACES.

By D. S. MUNRO, M.I.E.E.

During the recent war our national resources of skill and experience were woefully misapplied. So much had to be done, and there was so little time to do it in! No organisation existed for putting the skilled man where his skill would be most useful. Our great engineering societies could have done a great work in this respect, but they were not asked. Occasionally they were appealed to for men for certain work, and at once responded; but the men put forward were seldom given government employment commensurate with their knowledge and capacity. They were lucky if they were ranked only below their youngest apprentices; usually their departmental chiefs had been something even more inappropriate in pre-war days.

If, before the war, Britain did not stand first among the nations in the commercial exploitation of electricity throughout the world, it was easily first in scientific imagination and in inventive resource. Both in the war-army and outside it the country possessed great resources of capable men, some highly trained in the schools, and many in the practical applications and development of electrical and kindred branches of engineering. Our army methods in the generation and distribution of electricity for lighting and other purposes were as crude and wasteful as those of the Germans were efficient. Yet all the time there were in our armies hundreds of men who could have remedied this. If the army secured a first-class electrical workman, he was as likely as not to find himself an officer's servant, or in any other position where his special knowledge was wasted.

One has heard it stated as an example of German cuteness, that they could pick up our field telegraph messages. Of course, in the earlier years of the war, our field telegraph systems were so designed as simply to ask for this. In an army signalling lecture book, the familiar "Lineman's" or "Britannia" joint was described as the "German joint." But it is needless to multiply minor instances of a state of affairs which was notorious.

Now that this country is entering upon the period of reconstruction after the war, most of the skilled men will be absorbed back into civil industry, where they will sooner or later find their level. With national reconstruction schemes, government departments will have much to do. These departments will require big technical staffs, and these must be carefully selected if things are to go smoothly. Some of them will be formed from war-time staffs, and for these, in theory, the best men will be retained, the others being released. In practice this is not likely to be so. There is always the "easy supremacy of patronage over merit." The men chosen to lead are likely to be men of social influence rather than of practical capacity. They will at best be selected from men who find themselves at the head of large business concerns, a position usually, if not always, indicative of "good" business qualities.

When a strong man is at the head, he can control only by a rigid system of procedure, so "procedure" will continue its tyrannical and paralysing reign. System is a good servant, but a bad master. So long as the executive staffs consist of inferior men, strict "procedure" determining every act may be necessary. Thus any good man here or there will be so occupied and manacled by rules that all initiative and personal resource are eliminated. The whole staff may eventually consist of those who can move with the most perfect precision as the red tape permits and compels.

To lessen this inevitable evil, decentralisation is the only sure course. The kernel of the case for Individualism as against Bureaucracy lies in the freedom of initiative and the variety of method characteristic of the former. The danger of Individualism is that men who have acquired the knack of obtaining great sums of money for their schemes sooner or later kill off or absorb all competitors. Great companies and combines have all the disadvantages of

Bureaucracy without its national compensations. And there are many things good for the nation as a whole which a government may do but no combine would attempt.

Seeing, then, that we are about to witness the growth of national departments of engineering, it is of vital importance to the profession to consider its position during the selection of the staff and afterwards. The question may be considered from two aspects :—

1. How will it affect engineers generally—civil, mining, mechanical and electrical?

2. How can the government be assisted to choose and get the best men for their various jobs of all grades?

1. Take as illustration the coming great changes in electricity supply. Those engineers who now occupy salaried posts under local authorities or private companies are likely to fare best. Many of those displaced will be absorbed into the extended local distribution plans for power, heating, and lighting, and will remain, therefore, with their present employers. Others will be appointed on the high-tension cross-country cables; and the great central power stations should easily absorb the remainder, as well as some new men. If any are left out, they are going to be recompensed.

As to the foreman and rank and file, they are not dealt with in this article. If the right men are appointed as chiefs and sub-chiefs, good workmen will speedily find themselves in demand.

It is the local consulting engineers who may find themselves most seriously displaced. When the schemes were first mooted, and the support of engineers generally was appealed for, promises were made that vested interests would not be neglected, but rather improved. But when a government is about to spend public money, it is almost compelled to employ those consulting men who have a national reputation. If they propose to act anywhere under the guidance of a man of merely local repute, their schemes are more open to parliamentary criticism. It is hardly permissible to suggest that those consulting engineers whose commercial instincts have enabled them to build up a very big business, and who strongly desire to further its interests, might be prejudiced unconsciously against all proposals other than their own.

Yet there remains a possibility that government activities may have this usual result, that "to him that hath shall be given, and from him that hath not shall be taken away even that which he hath." Yet many of the provincial consulting engineers dealing with water power, electric generation and distribution, coal and steam economy, and the like, are the very best men in the country in their special branches. Apart, therefore, from the question of fair play to the men themselves, it is to the general interest of the country that these engineers should be employed upon the working out, erection, and maintenance of sections of the government schemes. The claims of local men assume further importance where nationality enters into the matter. A Scottish engineer, let us say, who has for many years been preparing local public opinion for such developments as those now contemplated, and who has hopefully gathered data and surveyed possibilities, is not likely to enjoy seeing the entire matter handed over to some excellent and influential London gentleman, the while his whole normal local field of work is destroyed by the new arrangement.

Take, as an example, the Coal Controller's war economy methods. It was a wise, and, indeed, necessary thing during war time to give free advice in detail to steam users as to how, by saving coal, they could save themselves hundreds, perhaps thousands, of pounds. But now that war is over, ought not government action to be restricted to putting pressure on these steam users, compelling them to economise coal, leaving them to employ the expert assistance of those independent engineers who are now very slowly rebuilding the practice which they temporarily abandoned for more urgent and direct war service? These remarks apply also to water-power development, light agricultural railway work, and other schemes.

The lessons of such considerations as have been mentioned may be summed up as follows :—(*a*) Centralisation and uniformity, good and useful as these are, must not be overdone. A central department having settled upon a general national scheme, should either appoint established local consulting engineers to investigate, report upon, and (with necessary modifications, if any) superintend sections of the scheme; or they should create or empower district authorities to undertake them, leaving these authorities to employ consultants, preferably more or less local. (*b*) Those consulting engineers who desire to be employed upon sections of the work should have their claims carefully considered by a government sub-department entrusted with the duty.

Some such policy as the foregoing would not only be fair to established interests, and provide an experienced body of assistants to secure economy and efficiency through their knowledge of local needs and conditions, but it would smooth away many possible sources of future friction in arranging with local authorities.

2. How to assist the government to select the best men. Those who have temporarily worked in government employ, know that the methods of selection were very faulty. They seem excellent on paper, but did not always work well in practice.

The method herein advocated is that engineers be selected with the help of the engineering institutions, but not solely or even chiefly through their general councils. For work in each district, the district sections of these institutions should be consulted, and even these should avoid the awkwardness of provisionally choosing men from around their own table by asking members generally to suggest names or to send in their own names as candidates if they desired the class of work offered. Thus for this purpose also, is suggested reduction of the rigidity of centralisation.

Later on, when contractors have to be appointed to undertake work, contracts also ought not to be made too large. To save trouble by letting large inclusive contracts, is to cancel the utility of thousands of those contractors who are the very best in the country. When competition is confined to one or two of the great contracting combines, the prices are apt to be high and the work moderately good. In any case, openings are provided for nepotism and a condition of things which calls for legislation against combines, and eventually for nationalisation as a remedy against the intolerable evils which we have helped to create.

The modern tendency is towards the creation of overswollen commercial Frankensteins. All the good that these can effect in extension of trading is due to their ready access to the money market. That advantage can be obtained otherwise if government reorganises the banking facilities of ordinary trade. As things are now shaping, the nation is building up new tyrannies of more unassailable privilege. Even the good and great Reconstruction Schemes may be moulded into machines for the further aggrandisement of select coteries. The workers' unions may disappoint some of these expectations—they are likely to do this so far as national benefit is concerned. When great industries are nationalised, their special workers have the unfair triple weapon of vote and strike and "go easy." Already we find the miners claiming beforehand all the prospective benefits of Reconstruction in getting and using fuel. If all follow this road, we enter the land of universal and unceasing disunion and strife. The wise alternative is a controlled individualism, and a public opinion alert for the interests of all classes, even of the unfortunate middle class, the geese that laid the golden eggs hitherto. If we must have nationalisation, let us avoid its more immediate and obvious disadvantages and injustices. It is as a small contribution towards this end that one has ventured to offer the foregoing suggestions.

In conclusion, is it archaic to desire the revival of the old and tried influences for the improvement of personal character and the old-fashioned virtues of plain living, high thinking and hard working? Nothing else will ever bring peace and happiness to any man or to any country.

Exports to German Austria and Poland.—The B. of T. gives notice in the *London Gazette* of April 4th, of general licence in connection with the resumption of trade with the above countries, under certain restrictions.

THE LIGHTING OF PUSEY HOUSE CHAPEL, OXFORD.

Pusey House comprises four blocks on the quadrangle principle. The chapel forms the north wing, and, with portions of the east and west wings, since completed, was the first to be built and electrically lighted. The lighting of the chapel was finished early in November, 1914. Current is taken from the 100-volt D.C. supply mains of the Oxford Electric Lighting Co.; the mains enter the east wing on the ground floor in one of the sacristies near the main entrance in St. Giles Street. They terminate in the usual fuse-boxes and meter of the supply company, from which they are connected through an ironclad D.P. main-switch fuse to an ironclad main switchboard provided with six main circuits, each controlled by interlocked D.P. switches and fuses. The sub-mains run from the latter into ironclad fuseboards in convenient positions in the different blocks, and the circuit wires radiate direct from these boards to the lamps, &c.

There is also a separate power supply at the same point of entry for the organ, accelerator pump and ventilating system; the power is, of course, separately metered and controlled, and kept quite distinct from the lighting.

The whole of the wiring, including the sub-main cables, whether for power or lighting (with the exception of the sub-main to the west wing, which is lead-covered and laid solid in bitumen in the quadrangle), is carried out in solid-drawn, galvanised, screwed steel conduits, forming with the ironclad boards (most of which are recessed in walls and covered with special oak doors, so that they are completely hidden), boxes, &c., a mechanically and electrically continuous system, earthed at frequent intervals.

No ceiling roses or wood blocks of any description are used. All switches are mounted inside galvanised iron boxes, in most cases recessed in the walls, with only the antique brass covers and dollies showing.

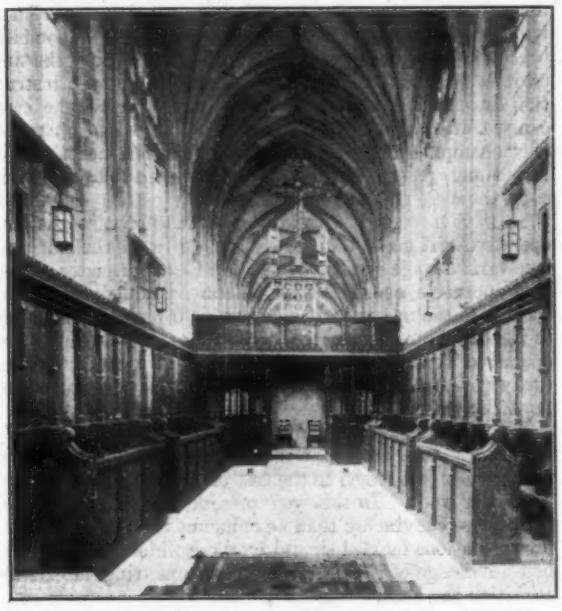

Fig. 11.—Concealed Lighting Fittings in the Chancel, Looking Westwards.

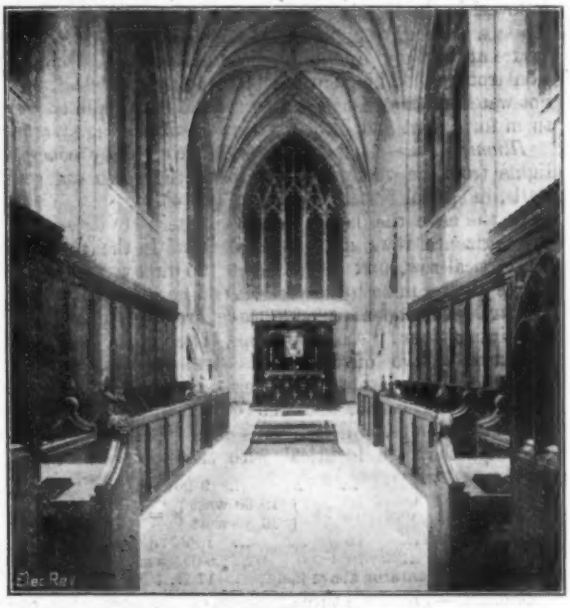

Fig. 2.—The Chancel Photographed by Electric Light, Looking Eastwards.

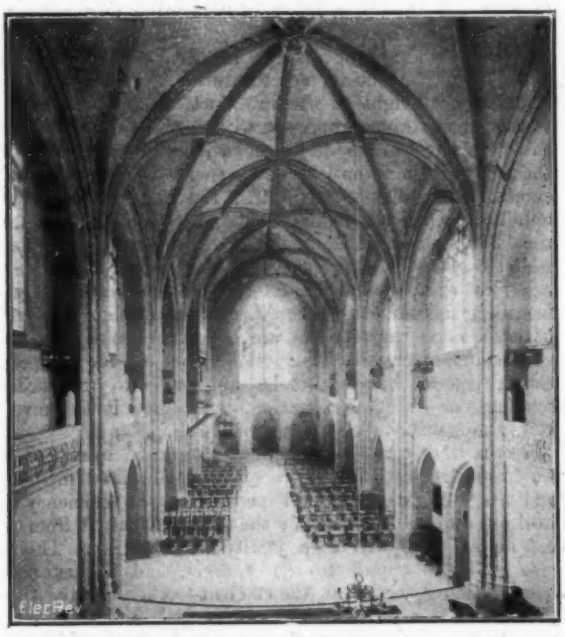

Fig. 3.—Concealed Lighting Fittings in the Nave, Looking Westwards.

Fig. 4.—View of the Nave, Photographed by Electric Light. Looking Eastwards.

The lights in the cloisters, passages, corridors, staircases, and in many of the rooms (library, lecture halls) are controlled by two-way switches, and, in certain cases, intermediate switches as well, so that no matter where one goes, the passage of approach can always be lighted, and the lights in the corridors or passages, &c., in the rear can be extinguished. In this way considerable economy is obtained, and the system has given great satisfaction.

Of course, the whole of the conduit system is concealed.

The conduits, where they pass in the heating trench or along the passage ways in close proximity to the heating pipes—and practically everywhere these runs had to be followed in the lighting of the chapel—are all covered with asbestos tubing, to prevent excessive differences of temperature arising, and to eliminate the possibility of condensation troubles. This plan has been highly successful. The hot-water pipes are not lagged, as the heat radiated from them forms part and parcel of the general heating system.

Illumination.—The Chapel is illuminated by concealed lights from the west window jambs on the north and south walls, in special lanterns (see figs. 1 to 4).

In the nave the lamps in each lantern are arranged in two horizontal rows at right angles, and in the chancel in one vertical row, and in each case the direction of a lamp can be altered in both the vertical and horizontal planes.

Nave.—On the north side there are five lanterns, each containing four "Axial" lamps, frosted, but no opal reflectors. Two of the lamps are 60-watt, and two 30-watt. On the south side there are only four lanterns, owing to the organ, and one of the lanterns contains only three lamps, which in this case are each 60-watt; otherwise they are identical with those on the north side.

Total	...	9 lanterns
Lamps	35	{ 19 60-watt / 16 30-watt } = 1,620 watts.
Floor area	...	1,892 sq. ft.
Efficiency	...	0·856 watt per sq. ft.
Height of lanterns above floor	...	17 ft. 1 in.

Chancel.—There are three lanterns on the north side, each containing three 30-watt clear "Axial" lamps with opal reflectors; two lanterns on the south side, ditto.

The passage beneath the gallery, from which access is obtained either to the chancel or nave, is lighted by two white alabaster bowl ceiling fittings, each with one 60-watt clear "Axial" lamp, and the light from these two fittings partially illuminates the first portions of the choir stalls at this end.

Total	5 lanterns.	
Lamps ...	17 { 15 30-watt / 2 60- " }	= 570 watts.
Floor area	...	1,180 sq. ft.
Efficiency	...	0·483 watt per sq. ft.
Height of lanterns above floor		11 ft. 10 in.

The lights in the chapel (nave and chancel) are controlled by switches centralised in one large galvanised box, recessed in the wall of the cloister under the tower by the entrance to the passage beneath the gallery. The cloister is on the south side of the chapel.

The electrical work was entirely carried out by Messrs. Hill, Upton & Co., electrical contractors, of Oxford, to the specifications and plans of Mr. H. G. Solomon, M.I.E.E., consulting engineer, London, and under his supervision. They also supplied, in accordance with Mr. Solomon's requirements, the special lanterns, the effect of which, as shown by the accompanying illustrations, is to illuminate the nave and chancel most efficiently, whilst the source of light is wholly concealed from the congregation. This is not an example of indirect illumination, but of direct illumination scientifically planned—attaining the desired result with a remarkably small expenditure of power.

Sodium as a Copper Substitute.—Before the war experiments had been made in Germany with sodium as a substitute for copper electrical conductors. The metal is obtained by electrolysis, and the difficulties that had to be overcome were its low melting point (at 96° C.), and the impossibility of using it in the open air. These difficulties were surmounted by using sodium in a fluid state and filling thin-walled iron pipes with the fluid. In the opinion of the *Zeitung für Blechindustrie*, this opens up a new way for German industry to make itself independent of foreign copper, inasmuch as sodium can be obtained cheaply from the inexhaustible stores contained in German beds of rock salt.

THE APPLICATION OF STANDARDS.

By Major E. A Pells, R.E.

Any work which has to be carried out with accuracy must be performed with strict regard to some predetermined measurement. Thus, in "Scientific Management," to get the perfect inter-relation of men, machinery, and industrial effort, it is necessary to have some predetermined standard which will form the basis upon which the efficiency of any industrial operation may be calculated. To facilitate the determination of standards, "Work Instruction Cards" may be used, setting out the various elements of a complete operation only, but as soon as the standard is fixed, the time allowed for each of these must be entered on such instruction card, so that the operative, when he receives the card, can see, after his first few attempts, just where he falls short of "championship form," and also the elements where he loses time. When introducing the standard into the workshop, the wage rate should be carefully adjusted; at the same time, it is necessary to provide an incentive, so that the operative will make a definite effort to reach the standard. The various wage systems will be considered in a later article. The incentive should be such that an additional reward accrues to the operative if he exceeds 60 per cent. efficiency, as if this figure is set too high, after a few failures, the operative becomes discouraged, and will put forward no further efforts, giving it up as a bad job and something beyond his powers.

When introducing any alteration into a shop, it will be found good policy to commence with one worker, thus providing an object lesson to the rest of the operatives engaged in similar work. In this you provide ocular proof, which is far more convincing than any amount of talk. Also, the first operations tackled should be those which will be to the best advantage of the operative, whilst upsetting the existing condition the least.

Never try to hurry at this stage, nor, in fact, at any stage, of the process of introducing "efficiency methods," as hurried results and "jumped-at" conclusions often spell disaster and the discrediting of "scientific management" in its entirety. Don't expect results of great magnitude too soon—a big change is not healthy. What is needed is a gradual evolution, not revolution. Remember, it is essential that right at the introduction of standards, the worker must become impressed with the opinion that he is getting a fair deal; he has been swindled so many times in the past that it is only by dealing with the whole matter carefully and disinterestedly that the best results can be obtained. Once the feeling in the shop is sure of the fact that the man engaged on the standard job is being very well treated by the management, and is making a good thing out of it, then all haste may be made to complete the installing of standards throughout the shop. Do not hesitate, once the workers are completely receptive, get your standard-practice instruction cards out for all operations; should, however, it be impossible to standardise some new or changing operation, don't allow it to prevent you from standardising the rest of the shop.

In the worker who introduces the standard by exposition we have the potential instructor in standardised methods, and in this way he will perpetuate the efficiency of working attained by himself; the increased output from the rest of the shop will soon justify his extra pay. This is also found to appeal to the workers, and invites their co-operation generally, as the efficient workers receive their just reward. A bonus should also be paid to the foreman, according to the number of men working under him who qualify for bonus or extra pay by exceeding an efficiency of 60 per cent., and if all his men qualify, an additional bonus. This has the effect of changing the foreman from a driver to an instructor and friend. Of course, one must not expect too much from the worker, whose interest in the success of the firm usually finishes at the pay table.

The introduction of any scheme by which the worker gets rewarded according to his skill, increases the pride and self-esteem of the worker. Also, it is a noticeable point that one's best bonus workers invariably provide one with one's future overseers and managers, and even although at

first they do not trouble much about the firm's prosperity so long as they get their pay, there comes a time when the thinking men among the workers must appreciate that the prosperity of the firm is their own, and that any scheme that might be put forward that did not benefit both employer and employé would tend to destroy democracy, and produce revolution. For prosperity of any kind not based on efficiency is an edifice on an unstable foundation.

To encourage a feeling of interest, it is a good idea to show in "graph" form the daily or weekly progress of the shops, thus arousing the sporting spirit of competition amongst the operatives. It often occurs that operatives have to be educated to the value of the standard methods, and one will sometimes find that a man who is giving bad results is disregarding some apparently small thing on the instruction card; this should not be allowed, and firmness is necessary, especially where the man has the support of his foreman, which may often happen.

Finally, once certain of your standard, stick to it, and as soon as the operative appreciates the value of standardised methods, you will have no trouble on that score. Never in a single instance have there been labour troubles at a works where efficiency methods have been installed on good scientific and sympathetic lines.

THE FULLER UTILISATION OF TRAMWAY PLANT.

By GEO. H. HOOLE.

At the present time very little goods traffic is carried over the existing tramway routes, even though in some towns a parcel service is afforded. The question therefore arises, how best to make full use of the existing plant, and that question can only be effectively answered when the solution provides for the maximum use being made of the plant.

Take any large town, and it will be found that along the majority of the routes there are warehouses, mills, factories, and workshops of every description from the patent medicine manufacturers, who send their goods in small lots, to the engineering firm, whose consignments are the heaviest. During one week, taking all the railway companies into account, it can be safely stated that hundreds of visits are made to these warehouses, &c., by railway lorries for the collection and delivery of goods.

It is for the tramway companies and corporations to provide facilities which will render unnecessary these visits of the railway lorries, and the major portion of the plant necessary to meet the requirement is already *in situ*, only connecting links being necessary.

The different goods yards of the several railway companies in most towns are central, adjoining a tramway route, and advantage should be taken of that fact to link up the goods yard with the tramway system.

The proposal, therefore, I wish to put before the readers of the Review is stated roughly as follows:—

1. Each railway goods yard should have an internal tramway system, *i.e.*, it should be possible to draw up a goods tramcar or freightcar to any of the warehouse landing stages, and also to run the cars alongside of the railway trucks as they stand on rail in the sidings.

2. The internal system mentioned in (1) should be linked up with the town system.

3. Manufacturers, &c., along the several routes of the tramway system should have small loop lines connected with the town system to allow of the goods tramcar entering that loop for loading and unloading to prevent interference with the town passenger system.

4. The goods cars should be worked by the Corporation of company, and not by the separate railway companies, so as to enable the collection and delivery of goods along a particular route, irrespective of by what railway company the goods have been, or are to be, consigned.

For instance, if, say, the G.N. Rly. cannot provide a full car load for delivery on one route, the car would complete its load with Midland Railway goods, and so on.

5. The charge made against the separate railway companies could be agreed to, at a per-ton rate, after the mean distance has been arrived at. The majority of warehouses, &c., would in most towns be within a three-mile radius.

6. Advantage should be taken of the quiet hours of passenger service for the conveyance of known large consignments.

7. Special goods tramcars should be of two patterns, for light goods, *i.e.*, equivalent to the ordinary lorry, and for heavy goods.

8. The heavy goods could be dealt with between the hours of 6 a.m. and 8 a.m., whilst the light goods service could be maintained throughout the day.

Take as an example the number of lorries running every morning between the goods stations and the markets. Now, it is reasonable to assume that the tramway goods car would carry twice or thrice the load of a horse-drawn lorry; the service would be quicker and a considerable saving effected if the goods tramcars were brought into use; the initial cost of the loop into the market would soon be covered.

Further, take the cases of firms who daily use each of the railway companies, Great Northern, North-Eastern, Midland. Such firms would not require separate cars, but one could distribute to each of the railway companies those goods proper to its system.

It is not necessary for me to enumerate the many possibilities which underlie the proposal, as they will be apparent to any student of organisation whose attention has been drawn to the congested nature of our streets, a congestion entirely due to the lack of organisation.

The present absurd system of collection or delivery of goods results in three or four lorries being in the same street at the same time—a duplication of service, waste of labour, and capital outlay.

Such a system would result in the following advantages:—

1. Quicker distribution and delivery.
2. Saving in men, horses, and lorries.
3. Facilitating the work of the goods yards considerably consequent upon the more rapid clearing.
4. The work at manufacturers' warehouses would also be facilitated, as one car would take the place of several lorries, and the loading of the car would be quicker than the loading of three lorries, consequent upon there being only one "drawing up" to the stage and "clearing off," as against three.
5. Saving of stabling, &c.

Whilst against these there would be:—

1. The cost of provision of cars.
2. The cost of loops and internal systems of goods yards.
3. The cost of power.

The system would result in a more efficient method of distribution, and from a national point of view this is very essential; a subject which should be exercising the brains of all interested in the nation's welfare.

We have to go forward in peace in the same spirit as we carried on the war, *i.e.*, we have to win, and we cannot win with an effete organisation.

Coal Tar or Coke Oven By-Products (Returns) Order.—The Ministry of Munitions has suspended the operation of the above order as from April 4th, 1919.

ELECTRIC VEHICLE PROGRESS.

In the March issue of the *Electric Vehicle* interesting particulars are given of a test of a 2-ton Edison electric over a period of four weeks. The vehicle ran over some of the worst roads and gradients in and around Birmingham, with loads at times exceeding two tons. The weather was particularly bad, and on some days there was snow. The following results are of interest: Total working time, 225 hours; total load transported, 849.2 tons; distance covered, 761.6 miles; total gross ton-miles (weight of vehicle plus load), 3,320; average miles per hour over whole working period, including standing time, 3.34; average load on vehicle over total distance covered, 1.115 tons; ampere-hours per vehicle-mile, 8.55; ampere-hours per ton-mile, 1.96; units per vehicle mile, including battery losses, 0.825; units per ton-mile, on same basis, 0.189. With electrical energy at 1.625d. per unit, cost of power per vehicle mile, 1.34d., and per ton mile, 1.2d. of load transported. The vehicle ran without a hitch, and covered a distance equivalent to 9,900 miles per annum.

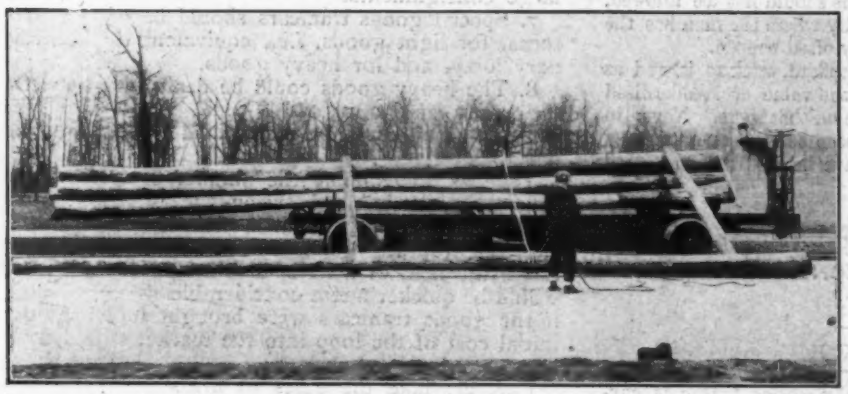

Fig. 1.—An Electric Pole-carrying Wagon.

Our illustrations, derived from the same source, show types of electric vehicles which for special purposes should prove very useful. In fig. 1 is seen a special pole-carrying wagon used by the Philadelphia Electric Co., while fig. 2 shows a powerful wagon with a motor on each of the four wheels, by the Couple Gear Wheel Freight Co., U.S.A.

Recent orders received by Messrs. Drake & Gorham, Ltd., for electric vehicles include three 3½-ton tipping wagons for Messrs. Greenall, Whitley and Co., Ltd., Warrington, two additional elevating platform trucks for Lever Bros., Ltd., and a works truck for Messrs. Tweedales & Smalley, Ltd.

The same firm has also supplied a 2-ton chassis to the Blackburn Corporation, a tower wagon to Warrington Corporation, four works trucks to Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., one works truck each to the Ford Motor Co., Ltd., and Callender's Cable & Construction Co., Ltd., and three elevating platform trucks to Lever Bros., Ltd.

Eloquent testimony as to the utility of electric vehicles for municipal services comes from Mr. W. E. Lowe, engineer and surveyor, Pontypridd, and we note that many Berlin carrying companies have turned over from horse-drawn to electric vehicles rather than to petrol-driven lorries in view of the saving that is effected. In lining up at railway stations, &c., the electrically propelled vehicle is not obliged to keep its motor running, as is the case with the petrol lorry. Enumerating the advantages of the electric vehicle, a writer in *Der Motorwagen* points to the simplicity of its construction, the ease of driving, and the certainty of keeping within reasonable limits the figures for repairs, depreciation, current consumption, &c. Owing to the ease with which they can be driven, electric lorries are specially adapted for such concerns as carrying companies, warehouses, and omnibus undertakings.

Seven new electric motor 'buses have recently been put into service in Rio de Janeiro. The bodies are of all-steel construction and somewhat similar in appearance to the street tramway car. Each car has accommodation for 32 passengers.

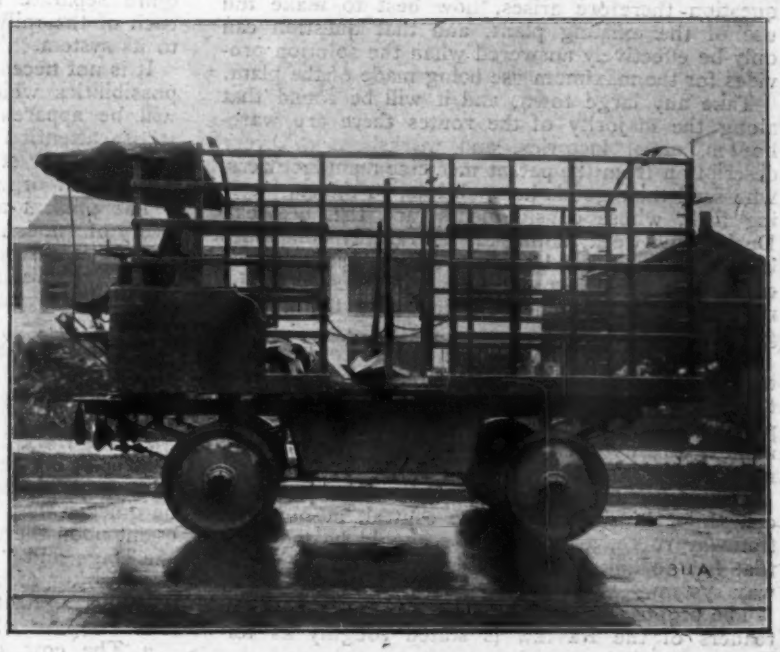

Fig. 2.—An Electric Wagon with 4-wheel Drive.

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Re-settlement of Officers.

In recent issues of the Electrical Review several letters have appeared under the heading of "Re-settlement of Officers." Surely "Fed-up" and "R.E. Sapper" are not under the impression that the fact of one's having held a commission is an essential qualification in applying for a technical post. The majority of employers are fully aware that there were just as good men in the ranks who, for some reason or other, did not get their commission, and naturally employers make their selection on purely technical grounds.

It is not necessary for "Fed-up" and others to point out that the fact of one's having held a commission is not a sure indication of technical efficiency. In my own experience, I have seen officers holding technical appointments whose lack of technical ability was deplorable, but who, fortunately, had good technical men under them who did their best to keep the plants in an efficient state. On the other hand, I have come across officers who were sound technical men, knowing their business inside and out, but the majority were not employed in a technical capacity; in the Army it is not always considered good policy to put square pegs in square holes.

With regard to some of the remarks made re commissions, I know of several cases where technical men have applied for a commission and have been turned down either on medical grounds or on the plea of indispensability. I myself made three applications, but was twice turned down on the former grounds and once on the latter plea, but still, that does not lead me to think that I have a grievance against those who held commissions. I advise "Fed-up" and "R.E. Sapper" not to worry about preference being given to those who have held commissions; in the majority of cases the employer is more concerned with technical efficiency than with the military rank an applicant may have held, and as "Fed-up" and "R.E. Sapper" are presumably fully qualified men they have nothing to fear in open competition.

In conclusion, I should like to point out that the Editors of the Electrical Review have not given undue preference to re-settlement of officers. In November last I was ap-

pointed Instructor in Electrical Engineering in Army Schools in France, and I asked the Editors' assistance in obtaining up-to-date technical matter; not only was every assistance given, but the Editors sent along a number of sound technical works from their own library, and these proved of valuable assistance to those attending the classes (all rankers), and I take this opportunity of thanking them for the invaluable assistance they gave to those who were fully alive to the need for technical efficiency on return to civil life. The letters *re* technical books were published in your issues of November 1st and November 29th under "Notes."

H. Bligh Hill.

London, N.17, *April 1st*, 1917.

Smooth versus Undercut Commutators.

I have very recently returned from France, and have just seen an article in your "Correspondence" Columns of the issue of December 27th, 1918, under the heading "Smooth *versus* Undercut Commutators." The article stated that on a certain set of rotary converters with undercut mica no trouble was experienced when running on a fair load or overload, but when they were operating at no-load the brushes commenced chattering violently. Inherently, undercutting the mica had nothing to do with the trouble, although the same trouble might not have been experienced if the mica had not been undercut, due to the difference in friction when operated with flush mica. The explanation lies in the fact that brushes have a lower coefficient of friction with high-current density than at low-current density, and this is particularly true of high-friction brushes. It is the writer's opinion that this is due to a partial graphitisation of the brush face, caused by the minute arcs through which the current is carried from the commutator to the brush. Several years ago the writer conducted extensive experiments along this line, and on one particular grade of brush found the coefficient of friction to vary from 0.82 at no load to 0.25 at 60 amp. per sq. in., with all other conditions maintained uniform.

E. H. Martindale,
Brush Engineer,
National Carbon Co., Inc.

Cleveland, Ohio, U.S.A., *March 19th*, 1919.

Consumption Curves for Power Stations.

With reference to the article on "The Coal Consumption of Steam Power Plant" by Mr. Robert H. Parsons, in your issue of February 21st, 1919, if you remember, you very kindly published in your issue of July 15th, 1910, a short article by me in which I advocated the use of the same coal consumption curves that are now being put forward by Mr. Parsons. I have used this method of checking coal consumption for about 10 years with excellent results.

A point to be observed in the use of these curves arises when steam-driven auxiliary plant is changed to electrical drive, as then a portion of the total units generated becomes actually a "standing charge," and the curves must be adjusted accordingly.

Roland Wheeler, A.M.I.E.E.,
Electrical Engineer.

Gibraltar, *March 26th*, 1919.

[The short article by Mr. Wheeler certainly contained the germ of the system, which is more fully worked out in Mr. Parsons's article, and he is to be congratulated on having developed the idea in practice. We again commend it to central-station engineers as a most valuable aid to economy and efficiency.—Eds. Elec. Rev.]

How NOT to Obtain a Situation.

A few weeks ago a letter appeared in these columns on the method of applying for a situation; I was too busy at the time to comment on it, but it appears to me that the fault is with the "hidden hand" methods of advertising in these days; this secrecy causes an enormous waste of time, paper, and postage, and there is no need for it, in fact it is in many ways dangerous.

I wonder how many of our employers are aware of the amount of private information about their businesses which has been supplied to Germany, and other countries, through these Box No. advertisements, not to mention other obvious dangers?

What I would say to situation advertisers is this:—

Don't advertise behind a Box No. above all things; if you don't want interviews in the first instance, say so; it's quite easy. Remember very few good men reply to Box No. advertisements, and no sensible man will give a lot of private information about himself or references to a Box No.

Don't say "state salary required," you know well enough what you want to pay, be British, and state it; if you want to vary it according to experience, state the limits, but don't make the lower limit too low; there is a big cry about more technical education, &c., just now, but before we have more technical knowledge there must be more incentive for it, as the capitalists say, if this country is to hold its own. Remember neither the capitalist nor the working man would be able to get a living if there were no technical men.

Don't say "not over 40"; in the engineering profession a man must be about 40 before he has really good, sound technical and business experience, and there are plenty of good men over 40 who have never had an opportunity of showing their best. Again, no sensible man is going to waste his time on high technical knowledge if he is not sure of a post at 40.

Further, say what you want in your advertisement; I have read dozens of advertisements which gave scarcely any idea of what was actually wanted, and again, don't think a man cannot do something if he hasn't happened to have actually done it before; our English employers stick in one groove too much.

To those applying for situations, I would say, leave Box No. advertisements alone; my experience is that they are hardly worth the paper and postage.

Wake Up.

April 7th, 1919.

Scientific Illumination.

I was recently on leave in London, and one evening found myself in the gallery of the House of Commons. For at least an hour I was absorbed in the faces and speeches of members, but as I began to relax and realise that the country's elect were, after all, ordinary folk like ourselves, I suddenly noticed a most remarkable thing—"Big Ben" had just struck seven, yet the chamber was illuminated, and no lamps met my eye. Suffused light was filtering through the immense stained-glass windows in the ceiling of the chamber in a most natural manner. It was just as though the sun were setting and throwing his last yellow beams inside.

I then noticed that the actual source of light was either clusters of lamps or half watt lamps placed above the stained-glass ceiling, and the light which reached the chamber was toned down and diffused in a most charming manner. At the same time one found no difficulty in reading. The effect must be seen to be realised. Later I noticed that members' seats under the gallery were illuminated by a few lamps, as they would otherwise be in the shade. I consider the lighting scheme of the chamber admirable, and an object-lesson—scientifically and artistically. I fear me that hon. members received but scant attention during the technical ruminations of

G. E. Moore.

B.E.F., *March 27th*, 1919.

[But it is possible to be too "scientific." As a striking example of the best-intentioned illuminating engineering producing disappointing results, the lighting of the lecture theatre of the Institution of Civil Engineers may be cited.—Eds. Elec. Rev.]

Rotor Currents of Slip-Ring Motors.

I should like to express my agreement with "Rotor" in last week's issue of your valuable journal. The manufacturer will greatly assist engineers in such installations by giving more technical data with regard to windings of stators and rotors, viz., rotor amperes, rotor volts, rotor resistance, stator resistance per phase, whether star or mesh connected, and radial air gap.

I have not known a manufacturer give any of the above data except by request. The writer was recently called to inspect a motor starter which was reported to be giving a great deal of trouble, since another motor had been substituted for the original one supplied with the starter; the electrician in charge remarked that it was of the same H.P. and the stator current was the same.

The suggestion given to the manufacturer by "Rotor" would greatly enlighten men in charge of such apparatus, when motors of different makes were adopted as spares.

C. Jones, M.I.E.E.

Chasetown, *April 5th*, 1919.

An Electrical Rupee Tester.—An interesting machine for use in automatically eliminating false coins from good coins is described in the annual report of the master of H.M. Mint, Calcutta, for the year 1917-18. The idea originated from Mr. Hart, of the Calcutta Mint, who placed his plans at the disposal of Messrs. Siemens Bros., with the result that the above-mentioned machine has been constructed. Rupees are placed into a hopper and mechanically ejected, one by one, so as to rotate on edge and roll down a narrow inclined plane fitted with guide strips, which delivers them into an intense magnetic field. Eddy currents are induced in the moving coins, which consequently experience retardation of movement in proportion to the currents generated. Good coins (of superior conductivity) experience most retardation, and fall into the first of two receptacles, whilst base coins (of low conductivity) are carried by their greater momentum into the further receptacle. The machine will not distinguish between good and counterfeit coin made of metals with similar conductivities. It can be used, however, to separate good coin from mint defective coin, such as split coin or coin containing air bubbles. As a general rule it is claimed that 90 per cent. of false coin in any remittance can be eliminated by it, and it should prove useful in mints, Government treasuries, railways, and banks.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Higgs Bros.' Electric Motors.

We have often dwelt upon the importance of specialisation of product in the past; it is vastly more important in the conditions which will obtain in the future, when it will be necessary to employ every possible means of reducing costs and increasing output—a double problem which is ever increasing in difficulty as wages go up, and working hours go down. It is interesting, therefore, to note that Messrs. Higgs Bros., of Summer Hill Street, Birmingham, pursue

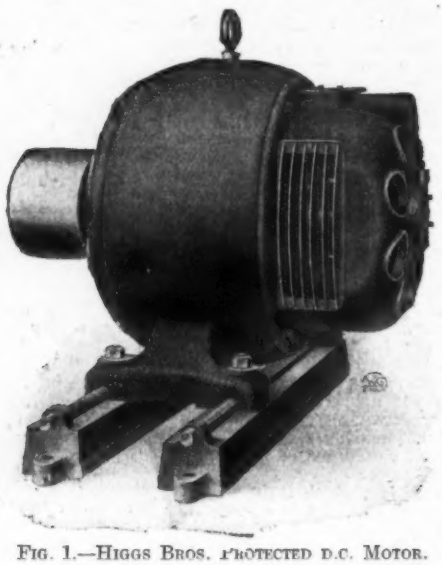

Fig. 1.—Higgs Bros. Protected D.C. Motor.

the policy of specialisation exclusively; they manufacture electric motors, and do nothing else—they do no factoring business at all. They concentrate all their energies on the design and manufacture of motors, and have thus become specialists in machines of small and medium size. Even when, in their early days, sometimes orders ran short, they did not take up other work—they closed the works for a time,

Fig. 2.—Field Magnet.

rather than depart from their settled policy. But that is a thing of the past, and is not likely to recur.

In view of the foregoing facts, the accompanying illustrations of some items of the company's products will be of interest. Fig. 1 shows one of its D.C. motors, protected type; these are made in sizes from 0.15 B.H.P. to 70 H.P., and are guaranteed to comply with the British standardisation rules, being sparkless at all rated loads without moving the brushes, and capable of carrying 25 per cent. overload for a time depending on the size of the machine. Every part is interchangeable.

Fig. 2 shows the magnet frame of the machine, which is fitted with interpoles. The yoke is of cast iron, with mild steel poles and laminated pole shoes; the field coils are wound with enamelled wire, and are readily removable. The armature is shown in fig. 3, with a patent fan mounted on the winding cup, the armature coils being former wound,

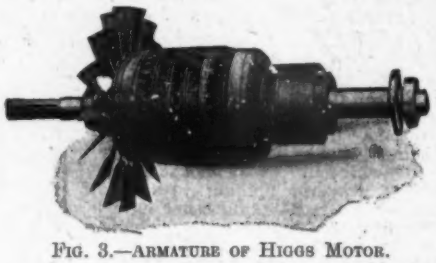

Fig. 3.—Armature of Higgs Motor.

and the commutator built up on a separate core. Roller bearings are used throughout. The end covers are of cast iron, with ventilating covers of patented design. Enclosed ventilated and totally enclosed motors are also made, as well as 2 and 3-phase induction motors, and small single-phase commutator motors (0.1 to 0.5 H.P.)

British Locomobiles.

Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, are building locomobiles of sizes up to 250 B.H.P., and will shortly issue full particulars. These machines which combine in one a boiler, superheater, compound engine, and, if desired, a condenser, represent the limit of compactness, whilst attaining to a remarkably high efficiency, and are very suitable under appropriate conditions for driving electric generating plant.

Amongst the advantages of the locomobile are the fact that the plant is self-contained, and requires little in the way of foundations, while it can be housed in a small and inexpensive building; whereas it is difficult to clean the water side ordinary semiportable boiler tubes, in the case of the locomobile the whole of the firebox and tubes can be bodily withdrawn, cleaned, and replaced in a few hours.

The "W.R." Combustion Indicator.

The accompanying diagram shows the arrangement of an ingenious device which has been perfected during the war by Messrs. "W.R." Patents, Ltd., 8, Old Jewry, E.C.2., and gives a continuous automatic indication of the percentage of CO_2 in flue gases; we are informed that it is already in use in several large generating stations, and is giving excellent results. As shown diagrammatically in fig. 4, an aspirator worked by a minute jet of steam continuously draws gases from the flue through a filter F into a chamber containing a porous pot, inside which is a dry reagent; a pipe connects this chamber with a vessel containing water, into which dips

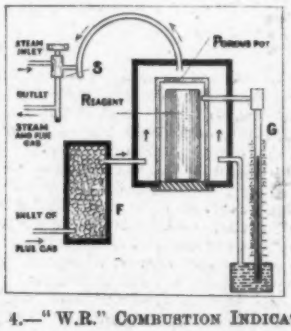

Fig. 4.—"W.R." Combustion Indicator.

one end of another pipe G, the other end of which is taken into the inside of the porous pot. Some of the gases penetrate into the interior of this pot, and are absorbed by the reagent, with the result that a partial vacuum is formed, and the water is forced up the pipe G. The latter is provided with a scale so graduated that the percentage of CO, in the flue gases can be read. Where forced or induced draught is in use, the steam injector can be dispensed with. The amount of steam taken by the injector is very small—not more than 1 lb. per hour. The only renewal required is a cartridge of absorbent, which is renewed every other day. The accuracy is said to be within 1 per cent.

THE ELIMINATION OF STATICS IN WIRELESS TELEGRAPHY.

The invention by Mr. Roy A. Weagrant, chief engineer of the Marconi Co., which we announced in our issue of March 14th, of a device which, it is claimed, will completely eliminate static interference of wireless signals, was explained in full last month at a joint meeting of the Institute of Radio Engineers and the New York Electrical Society.

According to the *Electrical World*, the inventor claims that it is possible to eliminate interference from the "grinders" by placing two low rectangular loops in the same vertical plane, but at the same elevation. The static waves, moving vertically, reach both loops simultaneously, whereas the signal waves, travelling horizontally from a given direction, set in vibration, first, the loop which is nearest to the sending station, and afterward the second loop. As a result the currents set up in the two loops by the static disturbance are in phase, and may be cancelled by proper connection of the loops. Currents set up by the signal waves will be out of phase by an amount depending on the sending wave length and the distance that the loops are apart horizontally. By placing them exactly one-half wave length apart a phase difference of 180 deg. will be obtained, but these currents can be made to add arithmetically by proper connection of the loops, so they really strengthen the signal received. Another advantage is that costly towers are eliminated. Experiments were mentioned by the investigator in which he was able to obtain very satisfactory results with antennas laid on the ground or slightly buried, provided that the length was not too great.

While the foregoing method eliminated "grinders," it did not reduce the disturbance from "clicks." Investigation indicated that the static waves producing these disturbances follow no definite direction, but seem to come from all azimuthal points. Of the many methods tried to eliminate these "clicks" one using three loops was most satisfactory. Two of the loops were placed as in eliminating "grinders," while the third loop was placed between. The connections were made in such a way that the currents produced in one set of loops by the second kind of static could be used to cancel those produced by the same cause in the other set of loops, leaving the signalling current free of disturbances. These devices have actually been tested on a commercial scale in a number of places and under very severe conditions. Mr. Weagrant has been able to maintain undisturbed communication with European stations during summer months and in the afternoon when disturbances are the worst. He has been able to screen out interference from neighbouring stations rated as high as 200 kw., provided that they are not in the direction of the sending stations—this by changing the directional-sensitivity characteristics, which can be easily done with three loops.

Mr. Weagrant has been able to receive trans-Atlantic messages with antennas which can be set up in an average-sized room, provided that amplifiers are used.

Several men noted in radio circles took part in the discussion which followed the presentation of the paper, and all hailed the investigation as an epoch-making accomplishment. The value of amplifiers in radio work was also emphatically brought out, their use and the manipulation of phase differences being two distinct steps in recent wireless development.

REVIEWS.

Electricity and Magnetism for Engineers. Part I: Electric and Magnetic Circuits. By Harold Pender, Ph.D. London: Hill Publishing Co., Ltd. Pp. xi + 380; 98 figs. Price $3.00 net.

This book is a distinctly quantitative account of the laws and phenomena of magnetism and electricity as applied to the generation, transmission, and utilisation of electrical energy. The author has realised that the electrical engineer must be able to answer not only "how," but also "how much"; he has therefore set himself the somewhat thankless task of writing a text-book in which problems are analysed quantitatively and definite mathematical relations obtained. The more popular and easy method of quoting formulæ should be studiously avoided by the electrical engineer, for both safety and economy depend upon his ability to solve problems not by a rule of thumb, which may have serious limitations, but by analysis based on first principles.

The quantitative idea underlying the book is an entirely admirable one, but its development in this volume cannot be regarded as entirely successful.

An introductory chapter gives a good account of force, work, and energy—fundamental conceptions without which no progress can be made. Chapter II introduces the general phenomena of the electric circuit, together with units and measuring instruments. The descriptions of the potentiometer, Wheatstone's bridge, voltmeter, and other instruments are simple and well illustrated. In general there is little to take exception to in this long chapter, but an extraordinary error of definition which is set out in specially bold type on page 62 must be pointed out: "The quantity by which the current in a given conductor must be multiplied in order to give the rate at which heat energy is developed in it is called the electric resistance of this conductor." The growing custom of explaining resistance by means of the heat equation $JH = I^2Rt$ is to be deplored, because it is an essentially clumsier method than that derived from Ohm's law; but when such circumlocution leads to errors such as that pointed out above, whatever tolerance we had extended to it must be withdrawn.

After defining E.M.F. as "the electric power developed in any source of electric energy per unit intensity of the electric current through it," the author arrives at Ohm's law, and then concludes a successful account of the difference between the E.M.F. (e) of a source and the P.D. (v) between its terminals by stating the following ridiculous equations: "$v = e - ri^2$ for a source of electrical energy; $v = e + ri^2$ for a receiver of electrical energy." No doubt the author has been guilty of careless proof-reading, but it will probably result in his readers getting singularly unorthodox notions concerning the dimensions of voltage, energy, and power.

The value of the two following chapters is considerably enhanced by the inclusion of 30 well-selected problems on continuous-current circuits and resistance. These are followed by two very brief and ordinary chapters on electrolytic conduction and sources of E.M.F., succeeded by an extensive treatment of the magnetic circuit.

The unutterable muddle into which the average student flounders concerning the relations between magnetic flux, magnetic intensity, magnetic-flux density, lines of force, lines of induction, and tubes of force, is largely the fault of text-books in which too little trouble is taken to define the terms used. Mr. Pender cannot be accused of this fault—his definitions are fastidious to a degree—but we must confess to a suspicion that, in spite of this fastidiousness, his chapter on the magnetic circuit will on the whole tend to increase rather than diminish the prevailing confusion. As an illustration of the general lack of perspicuity we may quote the following definition: "As the quantitative measure of the magnetic flux through any surface is taken the time integral of the electromotive force which is induced during the establishment of this flux, in the closed loop formed by the boundary of this surface."

The following chapters on the calculation of flux density and magnetic energy and eddy currents appear to us to be more useful, and are enriched with numerous problems with answers. The treatment of inductance and mechanical forces in magnetic fields is also of a higher standard than much of the earlier portion of the book. The establishment and decay of the current, the principles of the transformer and the alternating-current generator are all dealt with clearly and illustrated by examples.

Recognising the difficulties inherent in its production, we must allow that Mr. Pender's book, while imperfect in many details, has much to recommend it to the notice of engineering students. It is certainly likely to be useful to the engineer whose electricity and magnetism have been so essentially qualitative as to leave him unable to tackle practical problems.—P. H. S. K.

Gyrostatics and Rotational Motion. By A. Gray, F.R.S. London: Macmillan & Co., Ltd. Price 42s. net. Pp. xx + 530; figs. 122.

The theory of gyrostatic action is one of the most fascinating studies of the physicist, and one of the most important to engineers; it is, however, beset with difficulties to the non-mathematically minded, and pitfalls for inventors who do not thoroughly understand the peculiarities of gyrostatic phenomena, and is rarely expounded in such a way that the inexpert can form a clear conception of it. The author, pupil and successor in the University of Glasgow of Lord Kelvin, whose enthusiastic lecture demonstrations in this subject will never be forgotten by those who were privileged to witness them, has set himself the task of filling a gap in the literature of the subject by producing a treatise which, we believe, will become a classic—in which the theory and applications of gyrostatics are fully dealt with systematically and on the basis of constant reference to first principles, so that instead of mechanically absorbing a series of formulæ, the student shall be enabled to form a physical conception of the action of the devices which are discussed. Although the volume before us would appear to be exhaustive, the author has naturally been unable to include in it particulars of apparatus used for naval and military purposes, but a supplementary volume is foreshadowed for publication after the war to deal with these and kindred matters.

The contents of the book are necessarily very largely of a mathematical nature, treating first of the principles of gyrostatic action, then of tops and gyrostats, various physical and astronomical questions, flywheels, the whirling of shafts, and many allied questions. An ingenious gyrostat devised by Dr. J. G. Gray and Mr. G. Burnside, in which the flywheel is the rotor of a D.C. motor, is described. The stabilising effect of gyrostatic action on bicycles, ships, projectiles, &c., is discussed, and the gyrostatic action of revolving bodies, such as the rotors of turbines, is considered. The admirable treatise which Prof. Gray has provided will be of great value not only to students, but also to engineers, who will find many new applications for gyrostats as time goes on.

BUSINESS NOTES.

Good Friday Week.—Next Friday being Good Friday, the Electrical Review for April 18th will appear two days earlier than usual—that is, on Wednesday morning. All copy—editorial and advertising—should, therefore, be sent in at the earliest possible moment. The latest time for receipt of alterations to displayed advertisements is to-morrow, Saturday morning.

Our Letters from the Forces.—A correspondent writes:—"It is with feelings of deepest gratitude that I write to you. For two years you have faithfully supplied me with your excellent journal, which is undoubtedly the leading paper in the electrical engineering world, and which on account of its beneficence to the soldiers will, I am sure, be supported in return with a loyalty that it richly deserves. Your journal had a good name before the war; it has even a better one now. I have resumed my former duties in the electrical world, and shall constantly look forward to having the Review by my side, appreciating the aid of its bright intellectualism, its technical ability, and its advertising excellence."

A Willesden "Welcome Home."—The electricity department of the Willesden Council commenced a new era of social activity at the electricity offices, Salusbury Road, on the evening of Saturday, March 29th. The occasion was a "Welcome Home" arranged for some 20 members of the staff who have seen active service during the war. Councillor W. A. Hill, chairman of the Electricity Committee, presided. A meal, served by the Willesden Co-operative Society, was followed by a varied musical entertainment provided by the staff of the department. For the toasts, men of different sections of the service were grouped, each group being toasted by one of the lady members of the staff. Every man in turn replied to his particular toast. A toast in honour of the lady members of the staff was heartily drunk, as was the toast of the chairman and members of the Council present. The men who had been on service expressed their thanks to the Council for granting an allowance to those dependent on them during their absence. The room was tastefully decorated by the ladies. A Roll of Honour containing no fewer than 30 names (five of whom have made the great sacrifice) was exhibited. Accompanying this was a collection of photographs of all the men referred to in the Roll of Honour. A small pamphlet had been prepared setting out the work of the department. An introduction by the chairman of the Electricity Committee was followed by a brief record of every man's service in the Army.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for April 8th.

Iron and Steel.—The Ministry of Munitions announces that all subsidies in connection with the manufacture of iron and steel, including those on iron ore, coke, and pig-iron, will be withdrawn on April 30th, 1919. The control of prices and allocation of all descriptions of metallurgical coke, iron and steel scrap, cinder and scale, iron ore, pig-iron, manufactured iron, and steel and tinplates, will cease as at that date. Subject to the provisions of existing contracts, and to any regulations in force from time to time with regard to export, makers and others are free to make their own terms and arrangements in respect of delivery of any of these materials for home or export on and after May 1st, 1919.

Silvertown Cables.—Now that the Government Departments' demands for Silvertown rubber cables and wires have been relaxed, the India-Rubber Co. are in a position to devote practically the whole of their attention to ordinary industrial requirements. Prompt deliveries of all standard sizes can be made from the works, or any of the company's branches at Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, London, Manchester, Newcastle, Portsmouth and Sheffield. The firm have had great experience of cable manufacture having made and laid their first submarine cable in 1867. In addition to the standard "Association" rubber-insulated, taped and braided, lead-covered and armoured cables, they make the following special lines:—Hard cord-braided and leather-braided flexible trailing cables, for use in connection with coal cutters. Double wire-armoured cables, twin or three-core, for collieries, to meet the Home Office regulations. Fire-proof braided cables. Shot-firing wires, either rubber or gutta-percha insulated. Bell wires, all classes. Cotton or silk-covered wires for coil winding. H.T. and L.T. ignition cables to meet the Air Board specifications, also for use in connection with motor-car ignition. Flexible cord for use with heating apparatus. The Silvertown Co. has had 60 years' experience in the manipulation of the many varieties of india-rubber. Concerning the company's gutta-percha insulated wires, it may be remarked that the application of this material as an insulating medium has occupied a foremost place in Silvertown manufactures for a great many years.

Diesel Engine Amalgamation.—It is announced that Messrs. Petters, Ltd., have entered into an agreement with Messrs. Vickers, Ltd., for a combination of interests in the manufacture and sale of the Petter patent semi-Diesel oil engines. A subsidiary company is being formed, under the title Vickers-Petters, Ltd., with a capital of £500,000, in which the two companies will be the sole shareholders. Messrs. Petter's works at Yeovil are not included in the agreement, and varied engineering manufactures will be produced there. Vickers will transfer to the company the Ipswich works of the Consolidated Diesel Co., which they acquired during the war.

The Excess Profits Tax.—Addressing a meeting of the Bolton Chamber of Commerce, Lord Leverhulme said the Excess Profits Tax operated very unfairly. Profits should be set free to be poured back into business for purposes of development and expansion. By expansion of business cheaper goods would be produced and work would be found for a greater number of people. But the continuance of the tax would stunt the growth of businesses and greatly discourage enterprising young men. The tax would make it impossible to expand, and would even make difficult the maintenance of their business. The desire for expansion would also be killed. If they put fresh capital into their business, and made additional profit, the Government took 80 per cent. of it, but if they made a loss, they could take the whole of it themselves. It was a sort of nigger partnership—the nigger took the profits and Sam Johnson got the losses.

At an extraordinary meeting of Erinoid, Ltd., last week, Mr. Andrew Binnie referred to the effect of their application for an increased percentage over the statutory rate of 6 per cent. Having regard to the percentages which have been settled in the case of other undertakings, which did not compete with Germany, did not export from this country, and did not employ English labour, they had every reason to expect a reasonable increase. The result of the hearing of their case, however, was a serious disappointment to them. They were placed in almost the lowest category and given an increase of only 1½ per cent., making a total percentage on capital of 7½ per cent. "On an 80 per cent. basis, for every £5,000 made in excess of our standard we should have to pay £4,000 as duty, and of the remaining £1,000, roughly one-third would be taken as income-tax, leaving to the company only £600 out of £5,000. Out of that negligible margin we are expected to make good depreciation and other charges not allowed in the Inland Revenue computation of profits, also to provide additional working capital by way of reserves. As business men, you will realise that that cannot be done, and that increased sales cannot be successfully financed on such a basis. To put our case in a sentence, we were working hard to capture what was a German trade, and we have been, if I may use the expression, 'snookered' by the Inland Revenue. We were therefore bound to go carefully pending the production of the next Budget. The Inland Revenue methods of taxation by cramping new industries are restricting exports and employment and losing income-tax in the process. The officials do not seem to realise, if I may adapt a well-known phrase, that you cannot run an A 1 business on a C 3 standard."

If the excess profits duty was to continue, said Mr. Binnie, even in a modified form, new industries in this country had an overwhelming case for special consideration at the hands of Parliament. They should in fairness be placed on the same basis as pre-war industries of a similar type. The present methods discouraged new enterprises, and did not raise revenue from them.

Whitley Councils for the Civil Service.—The Committee who were appointed to consider the application of the Whitley Report to the Administrative Departments of the Civil Service, in their Report recommend its adoption with some modifications. In view of the essential differences between public and private employment, and the need for maintaining Ministerial responsibility and Parliamentary control, the joint bodies, the Committee consider, must be consultative, and must not be invested with any executive functions. According to the *Daily Chronicle*, it is proposed to establish a National Council for the whole of the Administrative Departments; one or more Departmental Joint Committees for each Department; District or Local Office Joint Committees in suitable cases; Sectional Committees of the Departmental Committee.

Overseas Trade Inquiries.—In the annual report of the Royal Colonial Institute, it is stated that since the signing of the armistice, large numbers of inquiries have been received from oversea firms and individuals desirous of being put in touch with British manufacturers and merchants with a view to obtaining goods which, prior to the war, were chiefly supplied by enemy countries; and also from persons wishing to act as representatives of British manufacturers. As a result of the introductions given, extensive business will be taken up.

Government Trade Missions Abroad.—In reply to a question in Parliament, Sir A. Steel-Maitland, of the Overseas Trade Department, states (according to the *Times*) that general economic missions have been sent under the auspices of his Majesty's Government to Poland and Serbia with the object, on the one hand, of investigating the requirements of these countries for material necessary to the reconstruction of their damaged industries, and, on the other hand, to inquire into the opportunities of developing British trade. It has been decided to send a similar mission to Belgium. A small mission has also been sent to Bulgaria to investigate the openings for British trade with that country. A special mission is at present in France dealing with questions relating to sugar-making machinery. Four investigators have been sent out by the Department of Overseas Trade in co-operation with trade associations in this country to inquire into the prospects and conditions of (1) the market for jewellery and electro-plate in South America; (2) the engineering trade in Brazil; (3) the confectionery trade in South America; and (4) the market for motor vehicles in Australia and the Far East. Other investigations of a similar character are now in contemplation.

Department of Export Restrictions.—The President of the Board of Trade has changed the title of the War Trade Department, to the "Department of Export Restrictions," but its address will remain at 4, Central Buildings, Westminster, S.W. 1.

Output of Iron and Steel.—The following statement as to production of iron and steel in the United Kingdom is issued by the Ministry of Munitions :—

Pig Iron.

	Output during week ending Mar. 15th, 1919. Tons.	Number of furnaces in blast.
Hematite	62,000	102
Basic	52,000	88
Foundry, forge, and other qualities	37,000	97
Ferro-alloys	5,000	13
Total	156,000	296

Steel Ingots and Castings.

Output during week ending March 15th, 1919 .. .. 185,000 tons.

Imports of Machinery into Australia.—Essential machinery which cannot be manufactured in Australia is to be admitted duty free.—*Times.*

The New Library at Birmingham.—The Chief Librarian of Birmingham (Mr. Walter Powell) reports this week to the Birmingham City Council that the work of getting together, reclassifying, and cataloguing the books suitable for inclusion in the new Commercial Library is well in hand, and with the return from the Army of members of the library staff, will soon be completed. In order to secure the interest and assistance of gentlemen associated with the trade and commercial life of Birmingham, the Libraries Committee has formed an Advisory Committee of representatives of the University of Birmingham, the Chamber of Commerce, the Business Club, the Rotary Club, the Birmingham and District Trades and Labour Council (artisans' industrial organisation), and the Birmingham Iron and Steel Exchange. It is hoped to open the library this month.

Trade Announcements.—Messrs. Wood & Cairns, Ltd., wholesale electrical factors, Edinburgh, Glasgow, and Dundee, have appointed Mr. John Pendreich as their representative in Fife, the Lothians, and the South of Scotland. Mr. Pendreich was formerly with the General Electric Co., Ltd., and Messrs. Millar and Stewart.

Messrs. Armstrong, Elder & Co. are amalgamating with Messrs. John Ackland & Co., Ltd., 80, Gracechurch Street, E.C., and the business is now being carried on under the latter name at the address stated. Mr. Henry J. Tossell (of Messrs. Armstrong, Elder) becomes a director of the concern. New and extensive premises have been taken at 12, Old Street, and 11, Middle Row, E.C., for warehousing large stocks.

Mr. H. Odell, electrical engineer, has opened the Spital Works, Windsor.

Mr. C. W. Newall, who has been discharged from the Forces, has commenced business as an electrical engineer at Earle Street, Crewe.

Messrs. Goodenough & Harris, electrical engineers, of Barnstaple, have taken larger premises at Rackfield, Bontport Street.

Messrs. Rose Bros., of London, have now opened a branch office and warehouse at 83a, Radcliffe Street, Bristol, for the wholesale trade only.

Messrs. Peter Brotherhood, Ltd., of Peterborough, have just opened a branch office at 47, Pilgrim Street, Newcastle-on-Tyne, under the management of Mr. E. Jones, late of the Mirrlees, Watson Co., Glasgow, to deal with their business in the North of England. Their specialities include air and gas compressors, steam engines, steam turbines up to 1,500 b.h.p., internal combustion engines of small sizes, centrifugal pumps, dynamometers, &c.

Messrs. Purit Specialties, Ltd., Park Street, Birmingham, announce that Mr. W. Balmford (late of British Westinghouse E.M. Co.) has been appointed their general manager. He will devote special attention to their "D.L.S." fittings, which are now offered from stock.

Mr. William Sykes, many years foreman for the Darlington Corporation Electricity Department, has commenced business on his own account as an electric light and power engineer at High Row, Darlington.

Stocks of Non-Ferrous Materials.—The following particulars are published of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on April 1st, 1919 :—

Copper	48,702 tons	Soft pig lead ...	96,456 tons
Spelter, G.O.B. ...	27,676 ,,	Nickel	2,389 ,,
Refined ...	10,371 ,,	Antimony regulus	4,361 ,,
Aluminium ...	11,210 ,,		

Trade Restrictions to be Removed.—The *Daily Telegraph* stated last Saturday that in official quarters it was understood that the Government would shortly be in a position to announce the removal of a number of restrictions which hampered the development of trade. "This action will be of great importance to the industrial community."

A Berlin Strike.—It was reported in the Press last week that the technical office employés of the Berlin metallurgical industry struck on April 2nd. The strikers included all categories of employés—engineers, draughtsmen, foremen, shorthand typists, &c., roughly estimated at over 30,000.

Joint Control of Canadian Industry. — A *Times* dispatch from Ottawa states that the Government has decided to appoint a Commission, consisting of representatives of Labour and Capital, to investigate the feasibility of joint control of industry in Canada by Capital and Labour. The Commission will visit various cities and take evidence.

French Companies.—The Société Industrielle d'Optique de Précision has been constituted at Paris, with a capital of 1,250,000 fr., to manufacture all kinds of instruments of precision and electrical and mechanical apparatus for the use of science and industry.

The Anciens Etablissements Edmond-Picard, Paris, mechanical and electrical mechanicians, have been converted into a company, with a capital of 300,000 fr.

Under the style of L'Outillage Electrique (Allion et Vignal) has been formed a company at Lyons for the manufacture of electric drills, sewing machine motors, and the installation of motors, alternators, and transformers.

The Electria is a company formed at Paris, with a capital of 450,000 fr., to carry on works now under construction at Bruay, for the manufacture of all kinds of electrical and mechanical material.

Government Sales.—Messrs. S. Dixon & Son, Ltd., of Leeds, have written to the *Times*, suggesting that the Government should issue in the *Board of Trade Journal* a weekly catalogue or summary of coming sales of Government material, as at present it is difficult to keep track of them.

Turbine Plant for Glasgow.—In our issue of March 28th, under this head, it was stated that the condensing plant would be of the Willans surface type, with duplicate air extraction plants on the Willans rotary water-jet system. We are informed by the Mirrlees Watson Co., Ltd., Glasgow, that this is not correct; the condensing-plant portion of the contract is being supplied by them through the English Electric Co., Ltd., as main contractors. The condensing plant is, generally, a duplicate of a plant now being erected by the Mirrlees Watson Co. at the Dalmarnock Station in connection with Messrs. Fraser & Chalmers's turbine, the only difference being that for the new set the air pumps are of the Mirrlees-Leblanc steam multijector type, fitted in two units. Each unit consists of four ejectors arranged in parallel; thus one or more ejectors can be operated according to the air leakage, which makes a most efficient and flexible arrangement.

Industrial Housing Schemes.—The Joint Housing Committee of the Federation of British Industries and the National Alliance of Employers and Employed have expressed the opinion that the new Housing Bill of the Government is a great improvement on existing powers, and will in the course of time do much to secure the building of working class houses. The Bill, however, is complex, and some delay must inevitably occur before it takes effect. In view of the urgency of starting building all over the country *at once*, both to meet the housing shortage and to curtail unemployment, the Committee urge the Government to pass a short Act enabling a grant per house to be made to any public authority or public utility society, for working class houses built within one year from the passing of the Act. As the cost of building has considerably more than doubled from pre-war prices, it is suggested that the Government should pay 40 per cent. of the cost of building, and that the grant should be given for a definite number of houses, say 100,000, distributed over the whole country. The Committee hold that the financial terms offered to Public Utility Societies should be at least as favourable as those granted to local authorities.

South African Trade Inquiries.—Since Mr. H. M. Senior, Trade Commissioner in South Africa, opened his offices at Winchester House, Loveday Street, Johannesburg, in February, he has received numerous inquiries showing a great desire to renew business connections which were suspended during the war. A library of catalogues, trade journals, and directories has been established at the office. Communications should be addressed to him as above.

Imports Restriction Committee.—The *Daily Chronicle* states that Mr. Stuart Bunning, chairman of the Parliamentary Committee of the Trade Union Congress, has resigned from the Imports Restriction Committee, as after attending its first meeting "the discussion convinced him that the personnel of the Committee was such that it was bound to report in favour of a Protectionist policy." The Trade Union Congress, which was allotted four seats on the Committee, is taking no further part in the proceedings. As already stated, Lord Emmott recently resigned the chairmanship of the Committee.

Foreign Trade.—The March Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

Imports.	*March*, 1919. £	*Inc. or dec.* £	*3 months*, 1919. *Inc. or dec.* £
Electrical goods, &c. ...	119,909	+ 53,561	+ 79,826
Machinery	1,743,350	+ 889,851	+ 1,660,737
Exports.			
Electrical goods, &c. ...	328,129	+ 217,122	+ 461,407
Machinery	1,950,148	+ 814,097	+ 1,544,893

Electrical Exhibition at Barcelona.—An international exhibition is to held at Barcelona in 1921 devoted to electricity and allied industries. The exhibition will be divided into 13 sections, covering the whole domain of constructive electricity. It is well known that before the war Germans enjoyed the major part of Spain's foreign custom, her exports being to a value of 25,326,184 pesetas in 1913. The exhibition should, therefore, offer an excellent opportunity for Allied exporters to improve their position in the Spanish market.

Fire.—A correspondent states that the electric generating station at Shilbottle Colliery, near Alnwick, Northumberland, was completely destroyed by fire on Monday morning.

British Scientific Products Exhibition.—At the Exhibition to be held at Central Hall, Westminster, from July 3rd to August 5th, the exhibits will be divided into the following sections: — Agriculture; Aircraft; Chemistry (inorganic and organic products, plant, laboratory ware and apparatus); Education; Electrical Appliances (including instruments, wireless apparatus and magnetos); Engineering (prime movers, traction, mechanical devices and models); Fuels; Medicine and Surgery (including bacteriological and X-ray apparatus); Metallurgy (ferrous and non-ferrous products, furnaces and plant); Paper, Illustration and Typography; Physics (mechanics, heat, optics, illumination, photography, sound); and Textiles. Other exhibits in suitable sections.

Canadian Engineering Standards Association.—The Canadian Engineering Standards Association has recently been incorporated, with head office at Montreal. The chief objects of the Association are to co-ordinate the efforts of producers and users for the improvement and standardisation of engineering materials; and to prepare and promote the general adoption of standards in connection with engineering structures, materials, and other matters and things, and from time to time to revise, alter, and amend the same. The following distinguished professional men are listed as the incorporators:—Sir John Kennedy, Dr. Robert Ruttan, Dr. John Bonsall Porter, Richard John Durley, and Henry Hague Vaughan, all of Montreal. The operations of the corporation are to be carried on without share capital.—*Board of Trade Journal.*

Book Notices.—"*Mechanical World* Electrical Pocket-Book for 1919." Pp. 274, 105 figs., and diary. Manchester: Emmott & Co., Ltd. Price 1s. net.—The present issue has been further enlarged and improved. The section on electric motors in industrial service has been re-written and expanded, and now contains information on the selection, operation, and care of motors. The new sections on the use of fly-wheels with electric motors, and on the care of commutators and brushes, will also be of interest. The sections on alternators, alternating currents, static transformers, and fuses, have all been re-written; while new sections have been introduced dealing with phase sequence, &c., and synchronous alternators. The sections on electric lamps and lighting have been partly re-written. The mathematical tables have been extended and additions made to several other sections.

"*Journal* of the Institution of Electrical Engineers." Vol. 57, No. 280. March, 1919. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains Lieut.-Col. W. A. J. O'Meara's paper on "The Functions of the Engineer: His Education and Training," and the discussions on the following papers:—"Carbon Brushes"; "The Use of High-pressure and High-temperature Steam in Large Power Stations"; and "The Supply of Single-phase Power from Three-phase Systems."

"Aeroplane Construction." By Sydney Camm. Pp. viii + 138; 126 figs. London: Crosby Lockwood & Son. 1919. Price 7s. 6d. net.

"Catalogue of Lewis's Medical and Scientific Library," including a classified index of subjects, with the names of those authors who have treated of them. Revised to the end of 1917. Pp. 492. London: H. K. Lewis & Co., Ltd. Price 12s. 6d. net.

"Annual Report of the Dominion Water-Power Branch, 1916-1917." Ottawa: Department of the Interior.

"Practical Elementary Manual of Magnetism and Electricity." By A. Jamieson. Tenth edition. Pp. xiv + 372; illustrations. London: Charles Griffin & Co., Ltd. 1919. Price 5s. net.

For Sale.—Preston Corporation tramway department has for disposal one heavy treble-geared tram-wheel lathe. For particulars see our advertisement pages to-day.

Edinburgh Corporation invites offers for one drum-type rotary water strainer, and three 1,500-kw. 6,600-volt three-phase switch panels. For particulars see our advertisement pages.

Liquidations and Dissolutions.—Resisto Electrical Manufacturing Co., Ltd.—A meeting is called for May 7th at 167, Fenchurch Street, London, E.C., to hear an account of the winding up, from the liquidator, Mr. De W. Layton.

Tramways and General Works Co., Ltd.—Winding up voluntarily. Meeting of creditors, April 22nd, at 57, Moorgate Street, E.C. Liquidator, Mr. E. C. Price.

British Huhn Metallic Packing Co., Ltd., London, E.C.—Return to contributories. First and final payment of £1 2s. 10½d. per share, payable at office of Official Receiver and Liquidator, Carey Street, W.C.

Larne Electric Light Works, Ltd.—A meeting is called for May 12th at Suffolk House, Laurence Pountney Hill, London, E.C., to hear an account of the winding up from the liquidator, Mr. J. D. A. Norris.

Owen Lucas & Pyke, consulting engineers, 39, Victoria Street, S.W.—Mr. O. D. Lucas and Mr. L. Pyke have dissolved partnership. Debts will be attended to by Mr. L. Pyke, who will continue the business under the style of Lucas & Pyke.

Catalogues and Lists.—Messrs. Ward & Goldstone, Sampson Works, Salford, Manchester.—New sectional list, No. M200, of 16 pages, giving many illustrations, descriptive notes, and tabulated prices, relating to electrical supplies for the motor-car, motor cycle, and the garage. A new range of electric side, head, and tail lamps, accumulators, Ford accessories, and high and low-tension automobile cables, is included. The list is really an advance supplement preparatory to the issue of their large catalogue.

"W. R." Patents, Ltd., 8, Old Jewry, London, E.C. 2.—Pamphlet on the "W. R." Combustion Indicator, which is described in our "New Electrical Devices" to-day.

Trading with the Enemy.—The *London Gazette* for April 4th and 8th contains a number of additions to the list of those with whom trading is prohibited, and the names of about 2,000 persons and bodies now removed from the list.]

LIGHTING AND POWER NOTES.

Aberdeen.—Loan Sanction.—The Secretary for Scotland has consented to the borrowing by the Electricity Committee of £100,000 for extensions.

Aberystwyth.—Proposed Municipal Purchase.—The E.L. Co. having intimated its willingness to dispose of its undertaking, the T.C. is taking the opinion of valuers on the matter.

Birmingham.—L.G.B. Inquiry.—Colonel Ekin held a L.G.B. inquiry last week into the application by the T.C. to borrow £1,626,140 for the erection of a new electricity generating station at Nechells. Mr. R. A. Chattock, Corporation electrical engineer, said the estimate for structural steel work was between £95,000 and £100,000, and a tender for £94,000 had been provisionally accepted. Colonel Ekin pointed out that the cost of the station in relation to the supply of electricity was higher than that at most places, and suggested that it was double what it was before the war. Mr. Chattock agreed that it was more than double; something like three times. Mr. C. P. Sparks stated that at the new power station, electricity would be generated much more cheaply and efficiently with new plant than was possible with a temporary station at Nechells, and with the old power stations at present used.

An inquiry was also held into an application to borrow £38,000 for the purchase of the Hams Hall Estate, near Coleshill, as a site for a new power station. Colonel Ekin remarked that the Council had made an excellent bargain. Both inquiries were concluded.

Bridgend.—E.L. Scheme.—At a meeting of the Bridgend, Penybont, Maesteg, and Ogmore and Garw Councils, it was decided that the engineers of the four Councils should prepare a joint scheme for the supply of electricity to the district; it was suggested that power could be obtained from the rivers in the district.

Bridlington.—Overhead Mains.—The B. of T. has consented to the Corporation using overhead lines for the supply of electricity at 220 and 440 volts to works in Penfold Lane.

Bolton.—Mains Extensions.—The Electricity Committee has decided to extend the mains from Duncan Street sub-station to Spa Road electricity works.

Bournemouth.—E.L. Charges.—The T.C. informed the Bournemouth E.S. Co. that it would be prepared to pay 33⅓ per cent. increase on the electricity charges if the company would waive the right to terminate the agreement in June next. The company could not concede this, and the Council is to continue to pay an increase of 25 per cent.

Carmarthen.—Electricity Charges.—The T.C. has agreed to receive a deputation from the E.L. Co., in connection with an application of the company to increase the charges for electricity by a further 20 per cent.

Cavan.—E.L. Schemes.—The B. of G. has appointed Mr. J. A. Kenny, of Dublin, to complete the scheme of electric lighting in the workhouse, which was being carried out by the late Mr. J. P. Tierney.

A scheme is also on foot for the formation of a company to install electricity in the town.

Chesterfield.—Proposed Loan.—With a view to improving the supply of electricity to the Whittington Moor area, the T.C. has applied for L.G.B. sanction to a loan of £8,600, for mains, buildings, &c.

Cippenham.—Motor Depôt.—At the annual meeting of the Slough and Datchet E.S. Co., the chairman said that as they had accommodation at their station for considerable extensions, they approached the authorities in December, 1917, with proposals for the supply of electricity to the new Motor Repair Depôt at Salt Hill. The terms were such that, in their opinion, a saving of many thousands of pounds would have been accomplished, and the necessity for the Government to build and equip an entirely new station with the necessary duplicate plant would have been avoided. Apparently no consideration was given to the proposal, as they learnt, through the Official Report of Parliamentary Debates in October, 1918, that the Government had decided to proceed with its own scheme. He was not in a position to state how far this had advanced up to the present.

Continental.—Russia.—The *Times* states that the Moscow water, electricity, and gas works and tramways are at a standstill.

Cost of Public Lighting.—Dr. Addison stated in the House of Commons, last week, that the expenditure of local authorities in England and Wales on public lighting for the year ended March, 1915, was £2,277,000.

Halifax.—Mill Driving.—Agreements with the following firms for the supply of electricity for mill driving have been signed by the T.C.:—Farrar Bros., Ltd., of Well Lane Mills; and Mr. Thomas Robinson, of Boothtown Mills.

New Plant.—The electrical engineer has been instructed to obtain quotations for a 1,500-kw. rotary converter and the necessary switchgear and transformer.

Charges for Motor Hire.—The Electricity Committee has decided to increase the charges for the hire of electric motors by 25 per cent., as from April 1st.

India.—Water Power in Burma.—The first hydro-electric installation in Burma has been made at Kannauk, in the Tavoy district, in connection with the wolfram mines there. The available energy is 1,000 h.p., but by the plant now installed only half the power is utilised. The head of water at the power house is 2,094 ft., and it is locally believed to be higher than any other installation save in a few instances in Switzerland and the U.S.A.—*The Times Trade Supplement.*

Ipswich.—National Electricity Supply.—The E.S. and Tramways Committee has recorded its objection to the proposal to place the control of electricity supply under the proposed Ministry of Ways and Communications, in view of the fact that supplies of electricity to factories and other users largely preponderate over supplies to railways and other undertakings which it is proposed to bring under the control of the new Ministry. The Committee considers that the best interests of the nation would be served by leaving the control of electricity in the hands of the B. of T.

Killarney.—Proposed Price Increase.—The County Kerry E.L. Co. is applying to the B. of T. for permission to increase its charges for lighting from 6d. to 8d. per unit.

Letterkenny.—E.L. Scheme.—The U.D.C. has decided to apply to the L.G.B. for sanction to a loan of £10,000 for the lighting of the town with electricity.

Lighting Restrictions.—In reply to a question, Mr. Bridgeman, on behalf of the B. of T., stated in the House of Commons that the question of the suspension of the present control of lighting during the summer months was engaging the attention of the Controller of Coal Mines, and a decision would be reached in the course of the current month.

Limerick.—Year's Working.—On the past year's working of the Corporation electricity department there was a deficit of £900.

Liverpool.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £122,155 for electric mains, £80,000 for plant and switchgear, £47,000 for boilers, economisers and accessories, and £21,000 for cooling towers and foundations.

Maidstone.—Proposed Loans.—The T.C. has applied for loans of £6,000 for electricity mains and £1,000 for services.

Maybole.—E.L. Scheme.—Representatives from the town have interviewed the borough electrical engineer of Ayr, and considered the advisability of introducing electricity for power purposes. The engineer's statement was favourably received, and a further meeting has been arranged.

Newcastle-under-Lyme.—Bulk Supply.—The B. of T. has issued an order permitting the Stoke-on-Trent T.C. to supply the Newcastle T.C. with electricity in bulk.

Nottingham.—In our report of the L.G.B. inquiry at Nottingham, a regrettable error crept into the statement that Messrs. Boots had offered a supply of electricity at £3 per kw., plus 8d. per unit. The error was obvious; 8d. should have read 0·8d., and we may point out that Messrs. Boots are not the profiteers our note might have suggested, their technical knowledge being far above making such unwarrantable charges for energy in bulk.

Pembroke (Co. Dublin).—Price Increase.—The U.D.C. has increased its charges for electricity by ¼d. per unit for lighting and ½d. for cooking and heating, as from April 1st.

South Africa.—Strike.—As a result of the T.C. deciding to dismiss 30 men from the municipal power station, the remainder of the employés struck work on March 30th, and refused to allow any lighting in the town. The strikers called for the resignation of the Town Council, and formed a Board of Control to act in conjunction with the general manager of the electricity works and tramways, to keep the tramways running. The dispute was settled on April 5th, on the basis of a 48-hours' week, payment during the strike, the appointment of a Committee to investigate into local government, and other terms.

Swansea.—Motor Rentals.—The Electricity Committee has decided to increase by 33⅓ per cent. the rentals for motors on hire.

Lighting of Workmen's Dwellings.—A report on the electric lighting of 27 workmen's dwellings showed that at 8d. per week the average price obtained per unit was 2·86d.; to meet the extra charges, depreciation of wiring, &c., the weekly charge is to be increased to 1s.

St. Helens.—Proposed Loan.—The Electricity Committee has decided to apply for L.G.B. sanction to a loan of £800, for the purchase of a transformer, switchgear, &c.

Walthamstow.—Proposed Bulk Supply.—The Electricity Committee has informed the N. Metropolitan E.P.S. Co. that it has no intention of taking a bulk supply of electricity.

Yorkshire.—Wages.—Representatives of a number of electric supply authorities in Yorkshire met in conference at the Leeds Town Hall, on April 1st, to discuss the advisability or otherwise of forming a Committee to consider questions of rates of pay and conditions of labour of employés in electric generating stations. The proceedings were conducted in private.

TRAMWAY AND RAILWAY NOTES.

Barry.—Proposed Extensions.—The U.D.C. has decided to communicate with the Cardiff T.C. regarding the extension of the tramways and electric lighting.

Birmingham.—48 Hours' Week.—The T.C. estimates that the recent concessions to its employés regarding hours of labour, &c., will cost £160,000 per annum, and an immediate increase in fares will be necessary.

Bournemouth.—Sunday Service.—The T.C. has recommenced the running of a Sunday tramcar service.

Bradford.—Supply of Material.—It is stated that 52 electric motors, for which the tramways department has been waiting for the past three years, cannot be delivered for four months. Strong efforts are being made to secure 800 tons of steel-girder rails, but it is said that a year will elapse before the order can be completed.

Continental.—Spain.—Railway Electrification.—H.M. Ambassador, Madrid, reports that in connection with the proposed Paris-Algeciras Railway the question of a sufficient supply of electricity for its operation has arisen. A scheme for a national network for distributing electrical energy has been suggested, the power to be derived from the water-power resources of Spain. The full amount obtainable is calculated at 2,300,000 kw. The limit, however, suggested at present for the calculation of returns is 300,000 kw., in addition to the 300,000 kw. already independently in use in the country. The total length of the main transmission lines is estimated at 2,350 km., and that of the feeders and branches at 2,050 km. The cost of the whole system has been estimated at about £5,200,000. The main distribution will be effected at 120,000 volts, 50 periods, which is that generally in use in the country. The conductors will be connected up with the principal waterfalls and coalfields, and particularly with those which are not well adapted for exploitation in the usual way. These coalfields will be used to supplement the water power in times of drought. The direct line between the northern frontier and Algeciras will probably be the backbone of the system, while that between Madrid and Valencia will constitute the main artery of traffic to Eastern Spain. After these lines, a direct route from Madrid to Vigo has been suggested, and, in connection with this, an addition of transmission lines passing through Corunna, Vigo and Ferrol, has been recommended.

According to a Royal Decree, the rates per unit and per km. at present in operation may be proportionately increased up to a maximum of 15 per cent., although this increase may exceed the legal maximum provided by the various railway concessions. The companies are obliged to keep a separate account of the revenue derived from the increased tariff, and this revenue will not be calculated to increase the realisable value on a possible reversion of the railways to the State.—*Financier.*

At the recent meeting of the Compania del Metropolitano Alfonso III, it was stated that excellent progress was being made with the construction of the underground electric railway at Madrid, and if the rolling stock and other material which had been ordered in the United States was delivered to time, it was expected that it would be possible to open the first section of the line in October next.

Switzerland.—The *Times* states that, in order to relieve unemployment, the States Council has voted £180,000 for preparatory work in connection with the electrification of the Brique and St. Gothard branch lines.

Darwen.—New Tramcars.—The Tramways Committee has decided to obtain tenders for the construction of three new tramcars.

Dewsbury.—Extension of Time.—The Electricity and Tramways Committee is applying to the B. of T. for an extension of time in respect to the completion of proposed tramways to Shaw Cross and Dewsbury Moor, the periods for which expire on August 18th and August 7th next.

Doncaster.—New Tramcars.—The T.C. has decided to purchase 10 new tramcars, at an estimated cost of £21,000.

Edinburgh.—Tramway Electrification.—The Sub-Committee which visited London and Bournemouth to inspect the conduit tramway systems has recommended that the cable system should be electrified by sections as soon as possible, and that the overhead system should be generally adopted. The recommendations have been adopted by the T.C.

Isle of Thanet.—Fare Revision.—The Isle of Thanet Tramway Co. has increased its fares by 50 per cent.

Lincoln.—Railless Traction.—A deputation from the T.C. has visited Bradford and Rotherham to inspect the railless systems in those towns, and is preparing a report on the subject.

Liverpool.—Proposed Municipal Purchase.—The T.C. has approved of the promotion of an order for the purchase of the Liverpool and Prescot Light Railway. It was stated that the 3¼ miles of track would be purchased for £18,000, and to repair the line it was estimated another £27,000 or £30,000 would be necessary.

Accident.—The report of the B. of T. inquiry into the collision between two electric trains at Brocklebank Dock Station on the Liverpool Overhead Railway, on January 13th, states that the general conclusion arrived at is that the incorrect position of a signal was the chief cause of the collision. It was clear that some failure of the signalling or train-stop arrangements must have occurred, but it was not easy to determine what actually took place. The collision took place in a fog, and a number of passengers were injured. A similar accident occurred in a fog on February 12th. The report states that the evidence in both cases showed that there was much to take exception to in many directions with regard to automatic signalling and block instrument working on this electric railway. Various technical amendments for the automatic signalling system are recommended, and the report states that if a reliable automatic system of signalling and train control can be arranged, it will not be necessary to retain block telegraph working, which in itself is ill adapted for a frequent service amounting to 18 or 20 trains an hour. There should, also, be telephone communication at all stations to both platforms. The company should be asked to submit its proposals to effect the necessary improvements.

Deputation to America.—The T.C. has decided that a deputation, consisting of the city engineer, tramway manager, electrical engineer, lighting engineer, and four members of the Tramways and Electricity Committee, shall be appointed to visit the United States and Canada for the purpose of inspecting and studying tramway systems and methods of street lighting.

London.—L.C.C. Pays Damages.—Judge Grainger last week, at Greenwich, ordered the L.C.C. to pay £150 damages to a young lady, who was injured as the result of a collision between two tramcars at Peckham in July last year.

Fare Revision.—Increases of from ½d. to 2d. per fare came into operation on the Central London, Piccadilly, and Bakerloo Tubes on April 6th. Increases on certain District routes have also been made.

Derailment.—A tramcar left the rails at the southern end of Blackfriars Bridge on Monday, and stood across both up and down lines. Traffic was for a time brought to a standstill.

Owing to an accident to a train near the Temple station on Thursday morning, one line of traffic on the District railway was held up, and passengers had to alight and walk along the line to the station.

Newcastle-on-Tyne.—Year's Working.—At a meeting of the T.C. it was stated that last year 101,000,000 passengers were carried on the tramway system, compared with 65,000,000 the year before the war. The receipts per car-mile were 1s. 6d., against 1s., and the working costs were 6·62d., against 3·22d. During the current year, £55,000 will be spent from the reserve fund. £14,000 was transferred from the surplus to the relief of the rates.

Worcester.—Wages.—Tramcar drivers in the employ of the tramway department have received an advance of 24s. per week over pre-war rates. By agreement, four women do the work of three men, and receive wages on a proportionate basis.

TELEGRAPH AND TELEPHONE NOTES.

Cable Ship Honours.—Four London men from H.M. cable ship *Monarch* were to be decorated with the O.B.E. on Saturday "for good work on cable ships in dangerous waters." Throughout the war London was in telephonic communication with G.H.Q. in France, thanks to the cable men. The present *Monarch* is the second ship of that name; the other was torpedoed in 1915, her stern part being blown right away. Depth charges dropped by the Navy played havoc with the cables. At the height of the U-boat attacks, a large number of hydrophone cables had to be put down for detecting the positions of enemy submarines.

Egypt.—Arising out of the recent disorders, a Ministry of Communications has been formed, which will "for the present" control telegraphs, telephones, and posts, as well as all the means of transport, &c.

Germany.—The Post Office announces that commercial telegrams may now be accepted at sender's risk for inhabitants of Germany territory on the left bank of the Rhine in Allied occupation, at a charge of 3d. per word, providing that such telegrams relate to the supply of goods to that territory. Personal or domestic telegrams are not allowed except to members of the Forces.

Post Office Wages.—The Government has agreed to the Post Office Controlling Officers' Association's reorganisation scheme. The increased pay will amount to £120,000 to £150,000 a year, dating from January 1st, 1918, and all grades have been advanced.

Syria.—Telegraph offices at Beirut and Tripoli were opened on March 15th, and will now take business or social telegrams in plain language, English or French, at sender's risk. *T. and T. Age.*

Telegrams for the War Zone.—The Post Office announces that commercial, personal, and domestic telegrams can now be sent at sender's risk and subject to censorship to the following countries at the following rates per word:—Austria (excluding Hungary), 3d.; Poland, 4d.; Esthonia, 5½d.; Czecho-Slovakia, 4d.; Albania, 4½d.; Turkey, 6d.; Montenegro, Bosnia-Herzegovina, Croatia, Rumania, Serbia, and Slavonia (*viâ* Eastern), 6½d.; Bulgaria (*viâ* Eastern), 7d.; Trieste, Illyrian Littoral, and Dalmatia, 2½d.

In every case the telegrams must be in plain language and written in self-explanatory English or French. The service is uncertain, and the telegrams are liable to delay.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared.)*

OPEN.

Australia.—Brisbane.—May 15th. Department of the Treasury. H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Melbourne.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (March 21st.)

Birr (King's County).—May 1st. Birr Electric Light and Power Co., Ltd. Hydraulic turbine and accessories, electric generator, reducer set and motor booster, switchboards, alterations to P. & G. storage battery, overhead distributing lines, wood poles and fittings. (See this issue.)

Birmingham.—April 12th. B. of G. Rewiring internal telephone installation, call bells, &c., at the 2/1st Southern General Hospital, Dudley Road. (March 28th.)

Dublin.—April 24th. Electricity Supply Committee. High-tension switchgear and alterations to existing switchgear. (See this issue.)

Dundalk.—April 29th. U.D.C. Electricity Department. Replating of storage battery. (See this issue.)

Eastbourne.—April 16th. Electricity Department. One water-tube boiler, with superheater and travelling-grate mechanical stoker. (April 4th.)

Lancaster.—April 25th. Corporation tramway uniforms. (See this issue.)

London.—H.M. Office of Works. Two 10-ton, three-motor type, 450-volt, D.C. travelling cranes, 42-ft. span and 60-ft. span. (March 28th.)

Hammersmith.—April 9th. Electricity Department. Exhaust steam feed water heater, hot air forced-draught fan and air heater. (See this issue.)

H.M. Office of Works.—April 14th. Supply of electric bell fittings to September 30th. (See this issue.)

Battersea.—May 1st. Electricity Department. One water-tube boiler, superheater, economiser and mechanical stoker, induced-draught plant for main flues. (See this issue.)

Sale.—U.D.C. Electricity Department. 200/250-kw., 460-volt. Diesel engine and generator, switchboard panel, &c. (March 28th.)

Tynemouth.—April 24th. Corporation. One 500-kw. rotary converter, with accessories. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Aylesbury.—B. of G. E.L. installation at the infirmary, &c:—

E. T. Mackrill & Sons	(accepted) ..	**£188**
G. C. Gowan		251

Barrow.—Town Council. Accepted :—

Motor-driven electric feed pump, £295.—James Howden & Co., Ltd.
Cables for turbo-alternator and auxiliary plant motors, £119.—Charles Mackintosh & Co., Ltd.
Gangway and handrail for switchroom, £22.—Babcock & Wilcox, Ltd.
E.H.T. switchgear, £740.—Ferguson, Pailin, Ltd.

Annual supplies :—

Engine, &c., oils.—Vacuum Oil Co., Ltd.
Engine room stores.—J. B. Bolton.
Packing and jointing material.—W. R. Thornton & Son, Ltd.
Joint rings.—W. J. Tranter, Ltd.
Copper wire, vaseline oil, joint boxes, switch cut-outs, &c.—B. I. & Helsby Cables, Ltd.
Para strip and prepared tape.—A. Arkine.
Insulating compound, bitumen and E.H.T. compound.—Dussek Bitumen Co.
Electrical stores and rubber gloves.—L. Andrew & Co.
Electricity meters.—Chamberlain & Hookham, Ltd.
Prepayment meters.—Ferranti, Ltd.
Earthenware pipes and troughs.—Doulton & Co., Ltd.
Brass saddles and pins.—General Electric Co., Ltd.

Doncaster.—Dick, Kerr & Co. Ten new tramcars ; car body, £1,145, £67 for the vestibule, and £589 for equipment, making a total of £1,792 per car, exclusive of truck.

Halifax.—B. of G. Electric fittings. H. Hodgson and Company.

King's Lynn.—Corporation Electricity Committee :—

Brush Electrical Engineering Co. — 1,000-kw. turbo-alternator and condensing plant ; interconnecting pipe work and air filter, £12,750 ;
British Thomson-Houston Co., Ltd.—400-kw. rotary converter, E.H.T. switchboard and D.C. switchboard, £4,150 ; 400-K.V.A. transformer and switchgear for sub-station, £1,025.

London.—Battersea.—Electricity Committee. Annual contracts :—

Coal.—Rose, Smith & Co., Ltd. ; Foster & Co.
Troughing bends, &c.—Callender's Cable & Construction Co., Ltd.
Electrolytic meters.—Reason Mfg. Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd. ; Ferranti, Ltd.
Trinidite joint-box compound and bitumen (six months).—Dussek Bitumen Company.

Manchester.—Electricity Committee :—

Motors.—Electromotors, Ltd.
Meters.—Ferranti, Ltd., and Chamberlain & Hookham, Ltd.
625-K.V.A. transformer.—Ferranti, Ltd. ; 250-K.V.A. ditto.—British Electric Transformer Co., Ltd.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Friday, April 11th. At 7 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems of Linking-up."

Royal Institution of Great Britain.—Friday, April 11th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Piezo-Electricity and its Applications," by Sir J. J. Thomson, F.R.S.

Saturday, April 12th. At 3 p.m. At Albemarle Street, W. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Junior Institution of Engineers.—Friday, April 11th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "The Training of the Disabled Man from the Electrical Engineer's Point of View," by Mr. F. H. Taylor.

National Foremen's Association of Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, April 12th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Birmingham and District Electric Club.—Saturday, April 12th. At 7 p.m. At the Grand Hotel. Paper on "Electric Converting Plants," by Mr. F. Gould.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 12th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Coal Cutting by Electricity and Timbering at Cannock Chase Colliery," by Mr. W. P. Cheung.

Institution of Electrical Engineers.—Monday, April 14th. At 7.30 p.m. At the Chartered Institute of Patent Agents, High Holborn, W.C. Informa meeting. Discussion on "Electrical Instruments," introduced by Dr. R. D. Gifford.

(**North-Eastern Centre**).—Monday, April 14th. At 6.45 p.m. At the Mining Institute, Newcastle. Ordinary meeting.

(**South-Midland Centre**).—Wednesday, April 16th. At 7 p.m. At the University, Birmingham. Ordinary meeting.

Industrial Reconstruction Council.—Wednesday, April 16th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Industrial Situation," by Mr. Stephen Walsh, M.P.

Tuesday, April 15th. At 5.30 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Planning Department in Scientific Management" ; opening address by Mr. J. P. Whiteford.

NOTES.

French Water Power.—The conviction of the need for developing the water resources of France, in view of the present and future dearness of coal, has had the practical result of the nomination by the Minister of Public Works of a Committee to study the most scientific methods of utilising the country's water-power on the largest scale. A further departure meditated is that of erecting hydraulic laboratories, fully equipped for the investigation of turbines and other water machinery under ordinary working conditions ; the erection of standardising stations for machinery employed in the hydro-electric industry, and testing stations for such machinery. The Technical Institute of Toulouse has gone ahead of this projected departure by planning an installation, estimated to cost between 1,500,000 and 2,000,000 fr., to demonstrate practically the best conditions of working high, medium, and low waterfalls, as well as a water-gauging station, with special regard to the circumstances of the region of the Pyrenees. The Government has recognised the value of such individualistic efforts, and deemed it well to encourage them by financial help. In response to the request of the Minister of Public Works, last year, Parliament voted 440,000 fr. in aid of private hydraulic laboratories, nearly half of which has already been allotted to the Toulouse Institute. A supplementary vote of 250,000 fr. has since been asked for to help the scheme for the erection at Grenoble of an electrochemical and electro-metallurgical institute. The third of the existing institutes—that of Nancy—is concentrating its attention on the use and improvement of electric motors.

Energy Consumption of Electric Ranges.—Some interesting figures showing the energy consumption of an electric range for a specially-cooked roast beef dinner were obtained at a recent sales banquet of the North-Western Electric Equipment Co., of St. Paul ; 55 members of the sales and executive staff of the company were present.

The menu pepared for the banquet included soup, roast beef, three vegetables, bread and rolls, pudding, and coffee. These foods were prepared with the following energy consumption :—

	Watt-hours.
Ten cans soup	469
18 lb. roast beef	2,325
1½ pecks potatoes and two cans peas	1,188
Five cans corn	300
Six loaves bread	1,000
Five dozen rolls	700
Fifty portions pudding	1,275
Seventy cups coffee	525
Total	7,782

The average consumption per person served was, therefore, 172·9 watt-hours. The entire cost for energy at the prevailing rate of 4 cents per kilowatt-hour was 31·128 cents, or 0·691 cent per person.—*Electrical World.*

Lock-Out Notice.—In the *Electrical Contractor* for April there appears a notice on behalf of the National Federated Electrical Association, signed by the general secretary (Mr. L. G. Tate), with regard to a dispute in progress between a London contractor and the Electrical Trades Union. It is stated that in 1914 the Union in London accepted a rule that no exception should be taken to the employment of any workman on the ground that he was not a member of a Trade Society, and it has never applied for a modification of the rule. The London Branch of the Federation would agree to a modification which, while precluding the engagement of Non-Union men, provided that the members should be entitled to continue to employ old servants who had been with them many years, but for their own reasons declined to join the Union ; the members of the London Branch emphatically decline to give an old employé the alternative of joining the Union against his will or immediate discharge.

Although no application for modifying the rule has been received, a London member has had all his Union labour withdrawn since January 8th last, and his customers have been threatened with the cutting-off of supply if they allow his men to continue at work ; the London secretary of the Union has stated that this procedure will be applied to all firms in succession. "The matter was reported to the National Joint Industrial Council, and various proposals put forward by the employers showing their willingness to assist the Electrical Trades Union in the gradual and peaceful absorption of all their workmen, and as a result the National Joint Industrial Council accepted an offer of the general and London secretaries of the Electrical Trades Union to recommend the London District Committee of the Union to withdraw the action taken against the firm in question, pending discussion of the difficulty by both sides within 14 days. At the same time, the employers' representatives agreed to withhold notice of lock-out until after the meeting of the District Committee of the Electrical Trades Union. Failing this discussion taking place, a lock-out appears inevitable."

Canadian Water-Power Appeal.—The Judicial Committee of the Privy Council, on Monday, allowed an appeal from two orders of the Appellate Division of the Supreme Court of Ontario in proceedings relating to the use of the water power at Niagara Falls for generating electrical energy and other commercial purposes. The title of the case was the Electrical Development Co. of Ontario, Ltd., *v.* the Attorney-General of Ontario and the Hydro-Electric Power Commission of Ontario, and a long report of the matter will be found in *The Times* for April 8th.

Indian Society of Engineers.—The proposed Indian Society of Engineers shows every prospect of becoming a body thoroughly representing the engineering professions in India. The rules have already been drafted, and the Viceroy has promised to preside at the inaugural meeting, which will be held towards the end of the year. It is intended to apply for a Royal Charter, and the Indian Government has promised its support in this matter. Amongst the officials who are taking a keen interest in the formation of the Society are Sir Thomas Holland, K.C.S.I., K.C.I.E., President of the Munitions Board ; the Hon. Sir George Barnes, K.C.B., Member of Council for Commerce and Industry ; and Sir Claude Hill, Member of Council for Revenue and Agriculture. It is expected that the membership of all grades will run into four figures from the start. The Hon. Secretary is Mr. E. M. Hughman Bombay Club, Bombay.

A Royal Visit.—The King and Queen, on Saturday afternoon, visited Sir Frederick Milner's Shell-Shock Hospital at Hampstead, where they witnessed demonstrations of the curative effect of electrical treatment for nerve cases, and inspected the institution and grounds. In the electrical department the visitors saw how patients had their affected parts "ironed" or "charged," and also bathed in electrically treated water, according as their particular cases required. Other forms of electrical treatment were also demonstrated.

Parliamentary.—West Hartlepool Corporation has applied for powers for the construction of new tramways and the running of motor-buses.

Walsall Corporation is applying to Parliament for powers to extend its area of supply of electricity, and to provide and run motor-omnibuses.

Birmingham Corporation is making application to Parliament for further powers to construct and equip new tramways, &c.

Rotherham Corporation seeks power to postpone the date of sinking-fund payments and for extension of the period for repayment of loans for the electricity undertaking.

Fatalities.—The *Daily News* states that, while crossing a gangway at the South Metropolitan Electric Light and Power Station, East Greenwich, W. Plumeridge (16), slipped and fell into the machinery below. He was dead when discovered a few minutes later.

In the Durie Foundry of Messrs. H. Balfour & Co., Ltd., Leven, Alex. Myles (55) was carrying an iron pipe through one of the shops when it came in contact with a live wire. The shock killed Myles instantaneously.

Of the six men killed in the explosion at Oxcroft Colliery, near Chesterfield, on Sunday night, two were electricians.

Borrowing by Local Authorities.—In February last Mr. H. Faraday Proctor, Hon. Secretary of the Incorporated Municipal Electrical Association, on behalf of the Council, wrote to the Local Government Board asking for relief in the matter of sanction to expend capital for the connection of new consumers; he pointed out that the gas suppliers had been very busy in making new connections, whilst electricity undertakers had had to look on. The L.G.B. replied that applications could now be made for connecting installations for industrial purposes, but Mr. Proctor rejoined that this limitation debarred the electrical equipment of new residential property, and, in particular, prevented the adoption of electric lighting in connection with the Government Housing schemes, whilst it also reacted unfavourably upon manufacturers and hindered the employment of labour. Further, the Board of late, whilst authorising loans for extensions of mains, had disallowed loans for "house services," which included industrial premises, and thus the extension of mains without powers to connect installations would be useless.

To these representations the L.G.B. replied as follows, on April 7th:—

"I am directed by the President of the Local Government Board to advert to your letter of the 19th ult., and to state that since the date of the Board's letter of the 10th ult., the Treasury restrictions upon the borrowing of money by local authorities have been further relaxed, and that the Board are now authorising the raising of loans for mains, services, transformers, and meters in connection with the supply of electrical energy, both for industrial and domestic purposes.

"As regards the latter part of your letter, I am to state that in cases where 'house services' have been referred to in the Board's letters, the applications of the local authorities have so described the works for which the loans were required. In such cases the Board will raise no objection to the expenditure of the moneys upon services required for the purpose of affording a supply of electrical energy for industrial purposes."

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following is a complete list of the members of the Wireless Sectional Meetings Committee (for Radiotelegraphy and High-Frequency Engineering) of the Institution of Electrical Engineers:—

President (*ex officio*).

Major E. A. Barker, M.C., R.E.	Prof. E. W. Marchant.
Mr. Charles Bright, F.R.S.E.	Dr. G. Marconi.
Dr. W. Eccles.	Major J. Erskine Murray, R.A.F.
Prof. G. W. O. Howe.	Mr. J. Sayers.
Admiral Sir H. B. Jackson, F.R.S.	Major T. Vincent Smith, R.A.F.
Mr. W. Judd.	Mr. A. A. Campbell Swinton, F.R.S.
Sir Oliver Lodge.	Mr. J. E. Taylor.

and

Capt. G. E. Im Thurn, R.N., nominated by the Admiralty.
Lieut.-Colonel A. D. Warrington-Morris, O.B.E., R.A.F., nominated by the Air Ministry.
Lieut.-Colonel W. Ll. Evans, C.M.G., D.S.O., R.E., nominated by the War Office.

North-Western Centre.—The annual general meeting of the North-Western Centre was held on Tuesday last, Mr. A. P. M. Fleming in the chair.

The Chairman moved the adoption of the annual report, which stated that the number of papers had been well maintained at the meetings (10 in number), the quality of the papers was high, and the discussions good. Special reference was made to the popular lecture delivered by Sir Ernest Rutherford, at which the attendance of the general public was most gratifying. It was the hope of the Council to make this a precedent for future years, and to contribute in this manner to the education of the public in matters electrical. There had been increases in all classes of membership, the numbers now being:—Members, 128; Associate Members, 487; Associates, 27; Graduates, 69; and Students, 129; a total of 833.

Mr. Allcock, in seconding the motion, said they must look back with satisfaction and pride to the fact that during the whole of the war period the membership of the Section had continued to grow, and the attendance had been always satisfactory.

A vote of thanks to the retiring chairman was passed unanimously on the motion of Mr. Robertson, seconded by Alderman Walker, who expressed a strong wish that the work done by Mr. Fleming among the Junior Section should be continued and developed.

Votes of thanks were also passed to the hon. secretary, Mr. J. Frith, who retired after seven years' service; and to Mr. A. L. Green, assistant secretary. The election of officers for the next year resulted as follows:—Chairman, J. A. Robertson; vice-chairmen, Alderman W. Walker, and W. J. H. Wood; hon. sec., Mr. A. G. Ellis; Committee, Messrs. Furlong, Lamb, Lunn, Peck, and Romero.

Institute of Cost Accountants, Ltd. (by Guarantee).—A series of lectures is being arranged for next winter sessions. Details will be announced later.

Glasgow Corporation Electricity Department Engineering Society.—This Society held its annual general meeting on March 31st, Mr. W. W. Lackie presiding. The secretary reported that the membership numbered 146, and that the average attendance at the 14 meetings held during the session was 71. Office bearers and members of Committee were appointed, and arrangements were made for the preparation of next session's syllabus.

The Irish Association of Electrical Station Engineers.—The second annual general meeting of the Association was held at Dublin, on March 28th. In the absence of the president, the chair was occupied by Mr. William Nolan. The minutes of the first annual general meeting were read and approved, and the report of the Executive Committee for the year 1918-19 was unanimously adopted. Mr. Wm. Nolan, Mr. W. P. Croly, and Mr. W. T. Dycher were unanimously re-elected as chairman, hon. treasurer, and hon. secretary respectively.

A report of the Executive Committee dealing with affiliation or amalgamation with the Electrical Power Engineers' Association was left in the hands of the Executive Committee, to report to a special meeting of the Association.

A discussion on the fixing of a minimum rate of salary or wages for engineers was left to be dealt with at an ordinary meeting.

The annual report states that during the year the organising of electrical station engineers in Ireland progressed very considerably. All stations were circularised, but it was found that many Irish engineers belonged to other bodies. The Executive Committee has seen that the rights of the members have not been infringed, and has taken action in some instances to safeguard their interests.

The members of the various grades are now as follows:—Honorary member, 1; members, 26; associate members, 23; graduates, 9.

In his address the chairman stated that this was the third attempt to form such an Association in Ireland. During the year all actions taken by the executive for improving the position of the members were successful. He wished members to constitute themselves agents, and to encourage electrical station engineers to join up, and to bring to the notice of the Executive Committee anything likely to be of advantage. If they improved their knowledge of electrical practice, and brought this knowledge to bear on their work, they would prove that they were entitled to promotion and improvement in position. It would then be known that the Association was for the good of all interests, and that for any concession they gained they intended giving their very best in return. Furthermore, their knowledge ought to be directed to the development of present and future industries in Ireland.

It is hoped during the next winter session to hold monthly meetings of the Central Branch, and members are desired to volunteer lectures or papers, so that a syllabus can be made out at an early date.

Society of Technical Engineers.—At the Industrial Conference, on Friday last, it was resolved that a National Industrial Council, representative of all industries, should be established, and the Minister of Labour, for the Government, warmly welcomed the proposal. On behalf of the Society of Technical Engineers, Mr. Norman Wyld urged that the Council should be instructed to consider how Unions composed exclusively of members of the technical management and administrative grades could be represented on Joint Industrial Councils. The matter was referred to the Joint Committee of the Conference.

According to the *Daily Dispatch*, the Society of Technical Engineers numbers 50,000 members, and, together with the industrial chemists, the bank and insurance administrators, and the learned professions, forms part of a movement towards a grand federation of the administrative grades of industry.

The Transport Bill.—On Wednesday, an amendment moved by Sir Eric Geddes, excluding municipal tramways from the scope of the Bill was agreed to; but Mr. Shortt stated that if a clause giving the Government a certain amount of control over such tramways were suggested, the Government would consider it very sympathetically.

Educational.—The Ramsay Memorial Committee has offered the University of London a sum of £25,000 towards the foundation of a laboratory of chemical engineering at University College. The Senate has gratefully accepted the offer.

Inquiry.—Makers of electric toasters stamped W.A.S.B. are asked for. A correspondent wishes to purchase, or to obtain the use of, an A.E.G. or other A.C. electrode furnace for hardening steel.

Appointments Vacant.—Switchboard attendant (60s. + 28s. 6d. + 12½ per cent.) for the Walthamstow U.D.C. electricity works; charge engineer (79s. 6d.) for the Stockton-on-Tees Corporation electricity works; shift engineer (£200) for the Accrington Corporation electrical engineering department; mechanician (£250 + £120) for the Posts and Telegraphs Department, Nigeria; electrical foreman (250 rupees per month) for the South Indian Railway Co., Ltd. See our advertisement pages to-day.

Super-Conductivity of Metals at Low Temperature.—The electrical resistance of perfectly pure metals disappears at the temperature of liquid helium, that is, at 1·9° F. absolute, or 490·1° below Fahrenheit zero. An article in *Zeitschrift des Vereines Deutscher Ingenieure* describes how it was not found possible to obtain gold and platinum perfectly pure, and their resistance in liquid helium did not decrease indefinitely, but remained at a very low constant value. Quicksilver can be obtained perfectly pure by distillation in a vacuum, and showed a decrease in resistance down to 7·55° F. absolute, which corresponded to $\frac{1}{5000}$th of the resistance at the solidifying point of quicksilver. At this temperature there was a sudden drop that immediately reduced the resistance to one millionth part of the initial value, and at 3·25° F. absolute the resistance was barely one thousand millionth part of the initial. This condition the author called super-conductivity. Tin and lead were also brought to the state of super-conductivity, the critical temperatures being 6·85 and 10·8° F. absolute, respectively. It was found possible to send a current of 1,000 amperes per sq. mm. through an extraordinarily thin wire of quicksilver, and 560 amperes per mm. through a lead wire without observing any heating effect or any difference in electric potential between the ends of the super-conductors. Experiments to produce magnetic fields of greater strength than 50,000 Gauss by means of coils of super-conductive wire failed. The super-conductivity of a double wire coil at 3·6° F. absolute was lost when the strength of the magnetic field rose above 1,000 Gauss, and the resistance assumed a definite value. A lead coil with an exceedingly low resistance at a temperature of 3·24° F. absolute, was exposed to a magnetic field of 200 Gauss, and an induced current of 0·4 to 0·6 ampere was observed after the removal of the field. The current decreased 1 per cent. per hour, and lasted four days before it disappeared. The current in such a coil disappeared immediately it was taken out of the liquid helium.

Strike at Pretoria.—Our South African correspondent writes:—"The tramwaymen's and power station employés' strike came to an end on March 14th, when the agreement was signed as follows:—

"A 48-hour week, the pay to be £5 7s. 6d. per week for the first year, £5 15s. 3d. per week for the second year, and £6 2s. 9d. per week for the third year. Minimum wage to be £4 10s. per week.

"Above to be temporary settlement, subject to a Commission being appointed by the Government to inquire into the whole industrial position, time limit for Commission to report being three months.

"This temporary settlement is made so as to end the present strike, and on the distinct understanding that any inquiry by the Commission must be based on the pre-strike wage and the original demands of the men.

"The Commission's finding to be binding on either side, and the finding of the Commission to be regarded as retrospective from the time work is resumed.

"This temporary settlement is made on the distinct understanding that there shall be no victimisation of any nature whatsoever on either side."

The full lighting service was resumed the same night, and the tramway service on the following day. The settlement is based on the difference between the amended offer of the Town Council and the original figures proposed by the Provincial Administrator.

Belgian Reconstruction.—It is stated that Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., have entered into negotiations with the Belgian Government to assist very largely in restoring the productive equipment of the country, so as to put it again on a manufacturing basis.

Electric Furnaces in Uruguay.—For some time past the Compania Industrial de Electricidad has had two electric furnaces in successful operation at Monte Video.

The Johannesburg Strike.—A communication just to hand from our South African correspondent says:—"In connection with the strike in the building trade, it has been decided by the Strike Committee to call out all electrical apprentices, on the ground that contractors have been able, with their help, to carry out certain wiring work on a number of jobs."

Electric Vehicles in Germany.—Dr. E. Valentin, in *Der Motorwagen*, discusses the advantages and disadvantages of electric vehicles, more especially in relation to German conditions. Up to the time the war broke out, Germany had developed the electromobile industry, and was second in the list of countries using this type of vehicle, the United States coming first. The principal uses of electrically-propelled vehicles are summarised by the author as follows: Fire brigades (34 brigades use this type of vehicle in Germany. Berlin itself had 50 electrically-propelled engines); street-cleaning carts; cabs (of which 475 were plying on the Berlin streets); 'buses and hotel cars. For refuse carts this type of vehicle is very suitable, owing to the running being intermittent. In some designs of refuse cart a special steering wheel is fitted at the side of the vehicle, enabling the driver to operate it from the ground. Many delivery vans and lorries are in use in Germany, of a carrying capacity of from ½ to 5 tons. The Berlin postal authorities use electric vehicles to a large extent, including electrically-propelled tricars for clearing letter-boxes. For ambulance vans, the electric vehicle is peculiarly adapted owing to freedom from vibration. Six German firms are occupied in the manufacture throughout of electromobiles, and another eight firms with the manufacture of various components. The author estimates that these six firms, if properly organised, could easily attain an output of 100 vehicles a month at the end of from eight to ten months. The manufacture of electric cars is specially adapted to series production. In this connection a very thorough system of standardisation is desirable. At present many designs are on the market, but, provided the parts of each firm were interchangeable one with another, a considerable source of difficulty would be obviated. A proper system of charging stations should be established in the larger towns, where used batteries could be taken in for charging and fully charged batteries handed over in exchange. A scheme of this kind is outlined by the author for the city of Berlin. If standardised dimensions, &c., were adopted by all firms it would be possible for public charging-stations to hire out batteries.

Starting of Large D.C. Motors without Resistance.—In 1912 it was calculated by Trettin that it was possible to start up large direct-current motors without starting resistances, the motor being thrown directly on to the line. W. Linke, in *E.T.Z.*, criticises the arguments given, and produces oscillographic test records in support of his views. It appears that if i is the maximum current rush obtained in switching a motor on to the line, and c is the theoretical short-circuit current, obtained by dividing the applied voltage by the total resistance in circuit, then the ratio of i to c depends on the value of the line voltage, the moment of inertia of the motor, and the counter-torque of the load being started up. The value $x=i/c$ is obtained from oscillograms taken under the various conditions just referred to.

The motor under test was a 60-KW., 440-volt, 700-R.P.M. machine, with 4 per cent. armature voltage drop at 250 amp., which load corresponds to the heating limits given by the German Institution Rules. The generator was a 1,000-KW. machine. With the machine unloaded the values of x obtained with 220, 300, 370, and 440 volts were 0.54, 0.59, 0.65, 0.72 respectively, the values of i and c at 440 volts being given by i=2,050 and c=2,850 amps. Up to 300 volts, sparking at the commutator was absent, at 370 volts sparking was bad, and at 440 volts arcing over occurred. Further tests were made at 220 volts with various moments of inertia. The value of i was 10 per cent. greater than before owing to decreased resistance of the leads used. The values of x for moments of inertia in the proportions of 1, 2, 50, were 0.5, 0.61, and 0.85 respectively; the actual values of i being 855, 1,050, and 1,420 amperes respectively. The effect of the load counter-torque was studied by driving a dynamo with separate excitation feeding a constant resistance, and it was found that practically no effect was produced on the magnitude or duration of the initial current rush by varying the excitation of the dynamo. In all the tests referred to (except the test with 50-fold moment of inertia) the duration of the initial peak of current was about 0.15 sec.

In the concluding instalment of this article the author describes a series of experiments made in the starting-up of large motors. It is found that with current rushes of as much as four times the normal current very little sparking is produced. This result was attributed by Trettin to the short duration of the initial current rush. The author, however, considers that it should rather be ascribed to the low reactance voltage in the short-circuited coils resulting from the low speed of the armature during the period of maximum current.

As the previous results have shown, the application of the full voltage without resistance in series with the armature is permissible only under very limited conditions, and it is shown that in general much more satisfactory starting-up is obtained with a one-step starting resistance. This single resistance step need only remain in circuit for a very short time, and may be of very small dimensions. It is put into circuit by a single switch with a double contact, which causes the circuit to be closed in two steps. If the resistance is of such a value that the permanent short-circuit current would be equal to the normal current, the motor reaches a considerable speed in a small fraction of a second, and if the inertia of the motor is not excessive, neither of the two current peaks exceeds the normal current. The length of time during which the resistance should be left in circuit increases with the inertia of the masses to be started up, if the current peaks are to be limited to the full load current of the motor. Oscillograms showed the variation of the starting current of a 200-KW. motor, which was started up without any sparking under various conditions of loading. The starting resistance was small enough to fit into a cigar box, and yet showed only 11 deg. C. rise in temperature for one start. After 15 starts at intervals of half a minute the temperature rise was only 120 deg. C. It would be possible to start up with this resistance unit once a minute continually without exceeding this temperature rise.

The War and Belgian Electricity Supply Undertakings.—Some interesting information has reached us regarding the position of two Belgian electricity supply undertakings now that the Germans have been driven out of the country. In a report drawn up by the Société d'Electricité du Brabant, it is stated that the war has left the undertaking in a difficult and serious position. As a result of refusing to supply current to a factory at Ruysbroeck which the enemy had seized for the manufacture of barbed wire, the undertaking of the electricity supply company was sequestrated by the Huns, who connected up the barbed wire factory with the sub-station at Ruysbroeck, and took the current that it needed. When the enemy retired in November last he took away all the books of the electricity undertaking, and all the money that was available. The generating station and the distribution system have suffered from neglect and also by the taking away of material. It has been found possible, however, to re-establish a supply of current, and the directors are taking all necessary steps to put the plant and system into proper working order in order to meet the current requirements of the district as soon as industry is re-established. The one bright spot in the outlook for the company is that during the war there has, owing to the difficulty of obtaining other lighting agencies, been a large increase in the number of electricity consumers who are expected to be retained now that the war is at an end.

The report of the Société des Centrales Electriques des Flandres states that when the declaration of war took place they were just on the point of completing their installations in Western Flanders. The generating station at Langerbrugge had just been put in operation, and they were actively engaged in extending power supply mains, and in connecting these up to the works of numerous industrial consumers. Owing to the calling up of men and the incertitude of the position, all this work had to be suspended. Later, when the supply of necessary materials became difficult, the question of the running of the generating station became a serious matter, and an arrangement was entered into with the municipal authorities of Ghent under which the company's plant was from time to time stopped, the necessary current for the company's purposes during those periods being supplied from the municipal plant, and this current being returned to the municipality when the company's station was running. This plan worked well for a time, and enabled both the company and the municipality to use the stock of coal on hand to the best advantage. When it became evident that the German occupation would be a long one, it was decided to continue the work of extending the installations, which enabled many villages entirely without light to be connected up, and also resulted in the company being able to prevent the requisition of its stocks of copper materials. On the eve of the armistice in November last, the generating station at Langerbrugge was systematically bombarded by the enemy; the damage done was severe, but the work of repair was promptly taken in hand, and the plant has again been put into operation. While owing to the scarcity of petroleum the number of current consumers from the company's plant increased from 1,665 at the end of September, 1913, to 10,407, in September, 1918, the demand for current for power purposes, to which the concern looked for its main development, had entirely been absent, and under this head the undertaking was fully five years behind in the position it had sketched out before the war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Bradford War Wages Committee is recommending a schedule of increases in the salaries of principal municipal officers, including an increase of £250 to the electrical engineer (Mr. T. ROLES), bringing his salary to £1,250; £25 to the assistant electrical engineer, bringing his figure to £478; and of £50 to the tramways traffic superintendent, increasing his salary to £478.

Burnley Corporation Electricity Committee has put into force the recent award to technical engineers. The effect of the award is to increase the salary of Mr. T. NUTTER, chief assistant, from £200 to £330 per year. Other advances are: Mr. J. Bolton, assistant, from £3 to £5 6s. 6d. per week; Mr. T. Taylor, assistant, from £2 17s. to £5 8s. per week; Mr. T. Riley, junior assistant, from £2 7s. to £4 11s. per week; Mr. H. Leaver, junior assistant, from £2 2s. to £4 5s.; Mr. W. Baker, motor superintendent, from £2 7s. to £4 11s.; and the four junior shift engineers from £1 12s. to £3 13s. per week.

Burnley Council has adopted the Electricity Committee's recommendation to grant the engineer, Mr. J. E. STARKIE, a bonus of £65 per annum. It was pointed out that Mr. Starkie was given an increase of £100 two months ago, making his salary £600. Coun. Nuttall said that Mr. Starkie applied for an increase some years ago, but at the wish of the committee, he postponed it until after the war.

Mr. MILNES, borough electrical engineer at Lancaster, having failed to obtain his release from the Army, has asked that his allowance from the Corporation may cease. The Council has decided to keep his position open.

Captain A. J. BECKETT, borough electrical engineer at Bridlington, who has been serving under the Admiralty, is being demobilised, and will shortly resume his duties.

The salary of Mr. R. H. CAMPION, electrical engineer at Dewsbury, has been advanced to £525 per annum.

Mr. M. S. MASON has been appointed chief assistant engineer by the Buxton Borough Council, with a special increase of £25 in two months. For the past three and a half years he has been serving in the Navy.

Mr. O. G. COOK, who has acted as assistant engineer for some considerable time to H.M. Military Power Station, Ripon, has resigned.

Barrow Town Council Electricity Committee has again proposed an increase in the electrical engineer's salary. At the previous meeting a proposal to make the increase £200 was defeated and a resolution was submitted suggesting arbitration, in the following terms: "That it be a recommendation to the chairmen of Standing Committees Sub-Committee, that in the event of the Council not agreeing to increase the salary of Mr. H. R. BURNETT, the borough electrical engineer, by £200 per annum, as recommended by such sub-committee, the question of the amount of salary to be paid to him be referred to arbitration, and that the Council be bound by the award given." After discussion, it was carried by 13 votes to 11 that the minute be deleted, although the Mayor had pointed out that if the matter was left for further consideration by a sub-committee they were not likely to adopt the proposal of arbitration.

Barrow Town Council on Monday approved the changes in the staff at the electricity works consequent upon the resignation of Mr. L. SEWELL, one of the charge engineers. Mr. T. E. Turner has been appointed to the vacancy at £104 per annum, plus 20 per cent., plus £90; and Mr. T. Wilson, of Ruabon, meter tester, at a commencing salary of £110 10s. per annum, plus 20 per cent., plus £90, with £10 towards cost of removal to Barrow. A junior charge engineer is to be appointed at a commencing salary, including all war advances, of £199 4s. per annum.

General.—Sir AUCKLAND GEDDES has accepted the post of Principal of McGill University, Montreal, where he was Professor of Anatomy at the outbreak of war. He has accordingly resigned the position of Minister of National Service and Reconstruction. During the illness of Sir Albert Stanley, Sir Auckland is acting on his behalf at the Board of Trade.

Mr. H. N. SPORBORG, of the British Thomson-Houston Co., Ltd., is a member of Rugby's War Memorial Committee.

The Bradford Corporation General Purposes Committee recommends the appointment of Mr. FRED MARSDEN, deputy city engineer, to be city engineer, at £700 per annum, rising to £800, in succession to the late Mr. W. H. Dawson.

Mr. A. E. FARROW, manager of the Windsor & Slough Electric Supply Companies, and his wife have, on their silver wedding, been presented by the staff with a silver épergne.

Manchester Education Committee has approved of the appointment, by the Municipal College of Technology Sub-Committee, of Mr. A. E. CLAYTON, A.M.I.E.E., as lecturer in electrical engineering, at £350 per annum.

Captain S. K. WATSON, R.I.E., late selling engineer for the British Westinghouse Electric & Manufacturing Co., Ltd., and the General Electric Co., Ltd., and Lieut. W. A. SYCAMORE, late gas-engine selling engineer for the British Westinghouse Co., are joining the staff of the Keighley Gas and Oil Engine Co., Ltd., the former as salesman in the Yorkshire district, and the latter attached as selling engineer to the London office.

Sir CHARLES J. STEWART, K.B.E. (late Public Trustee), has been elected to a seat on the board of the Marconi International Marine Communication Co., Ltd.

Mr. CHARLES WYATT, A.M.I.E.E., has resigned his position in the chief electrical engineer's department, R.A.F. (Air Ministry), having been appointed manager of the electrical department of the Globe-Wernicke Co., Ltd., 22, Kensal Road, W.10. The company have opened the department for the installation of electric lighting, power, &c. Catalogues, lists, &c., are desired.

Roll of Honour.—Corporal R. SMITH, R.A.S.C., who was formerly an electrician at Bentley Colliery, Doncaster, has received a testimonial from the City of Pavia (Italy), for saving the life of an Italian soldier, who was in danger of drowning in the Ticino river.

Sapper A. WILLIS, R.E., who has died from illness contracted on active service in Egypt, was formerly in the wireless department of Messrs. Johnson & Phillips, Ltd., of Charlton, S.E.

Private H. RICHARDS, R.E., who was previously on the electrical staff at the power station of the Isle of Wight Electric Light Co., at Ventnor, has died from pneumonia at Tembi, Persia.

Lieutenant W. T. MCKENZIE, Glamorgan Fortress Engineers (Electric Lights Company), has resigned his commission owing to ill-health contracted on active service, and retains his rank.

Obituary.—Sir William Crookes, O.M.—By the death of Sir William Crookes, on April 4th, at the age of 86, electrical science has lost one of its most noted investigators, one whose name will for ever stand in the front rank of original researchers and fertile thinkers. He was by training a chemist, and at first confined his attention to industrial chemistry, but eventually became professor of chemistry at the Training College, Chester. In 1861 he discovered the new element, thallium, and incidentally invented that interesting little scientific toy, the radiometer; his continued researches in connection with high vacua led him into that virgin but fertile field in which he reaped his most noted harvest of discoveries, ranging from the familiar "Crookes tube" to the phenomena which laid the foundations—and indeed formed no small part of the structure—of the modern theory of the constitution of matter and the electron theory. Thus the work of Sir William Crookes in great measure paved the paths which have led later investigators to the development of X-ray apparatus, and of the three-electrode valve evolved from Dr. Fleming's invention, so that indirectly it had a material influence on the war. He must be credited with remarkable insight, almost amounting to prophecy, in expressing the view that the constituents of atoms might, under suitable conditions, move as free particles, and again in his presidential address to the British Association in 1898, when he discussed the fixation of atmospheric nitrogen, and foresaw a time when the world's store of natural fertilisers would be inadequate to meet the demands for food of an ever-increasing population.

During his long career he was awarded most of the honours of the scientific world; he had been president of the British Association, the Chemical Society, and the Institution of Electrical Engineers, as well as of the Royal Society, a member of the Order of Merit, and the holder of various medals and other distinctions. Active up to the last, he developed a series of special glasses for protection from ultraviolet rays last year; his "spinthariscope" has served to bring home to the public an inkling of the wonders of radium. He was a firm believer in the possibility of communicating with those who had passed through the veil, and was an earnest investigator of psychic manifestations.

Mr. G. R. Henley.—We regret to record the death, which occurred on April 1st, at the age of 56 years, of Mr. George Robert Henley, secretary to Messrs. W. H. Allen, Son and Co., Ltd., of Bedford.

Prof. H. J. G. du Bois.—The death is reported from Berlin, at the age of 56 years, of Henri Johann G. du Bois. Born at Velp, Gelderland, he studied at the Technical High School at Delft, afterwards spending three years, 1883-85, in Glasgow with Lord Kelvin, then Sir Wm. Thomson. Later he was at Stuttgart, where he devoted much time to research work in connection with electro-magnetism, was professor at the Berlin University from 1896 to 1902, later at Utrecht, and back at Berlin where he eventually established what is known as the Boschal Laboratory.

Prof. Simon.—The death is announced, at the early age of 49 years, of H. T. Simon, Professor of Physics and Applied Electricity at the University of Göttingen.

Mr. John Shanks.—The death is reported of Mr. John Shanks, managing director of Messrs. Shanks & Co., Ltd., engineers.

NEW COMPANIES REGISTERED.

James Dawkins & Co., Ltd. (10,282).—Private company. Registered in Edinburgh, March 27th. Capital, £2,000 in £1 shares. To carry on the business of electrical engineers, armature winders, suppliers of electrical accessories, &c. First directors:—T. H. Muir, 67, Oxford Drive, North Kelvinside, Glasgow, cashier, 150 shares; J. Dawkins, 73, Manor Road, Motherwell, electrical engineer, 50 shares; J. Wardrope, 10, Woodside Walk, Hamilton, electrical engineer, 150. Registered office: Rosebank, Tollcross, Glasgow.

Dyson Wright & Co., Ltd. (154,013).—Private company. Registered April 1st. Capital, £1,000 in £1 shares. Electricians, engineers, &c. The subscribers (each with one share) are:—J. Dyson, 289, Toller Lane, Bradford; A. Wright, 94, Undercliffe Lane, Bradford. Registered office: 72, Market Street, Bradford.

Caldwell, Ford & Co., Ltd. (153,979).—Private company. Registered March 31st. Capital, £3,000 in £1 shares. To take over the business of electrical engineers, &c., carried on as Caldwell, Ford & Co. at 4a, McDonald's Lane, Corporation Street, Manchester. First directors: C. C. Headley, Oakdene, Derbyshire Lane, Stretford, Manchester; and J. Ford, 22, Parker Street, Levenshulme. Registered office: 4a, McDonald's Lane, Corporation Street, Manchester.

Portable Electric Motors (1919), Ltd. (154,099).—Private company. Registered April 3rd. Capital, £50,000 in £1 shares. To acquire the business of electric motor and cutter manufacturers and dealers now carried on by a company with similar title at 121, Victoria Street, S.W. The subscribers (each with one share) are:—G. Fryer, 252, Trinity Road, Wandsworth Common, S.W., electrical engineer; Baron Clifford of Chudleigh, 67, Madeley Road, Ealing. Registered office: 121, Victoria Street, S.W.

Ballymoney Light & Power Co., Ltd. (4,675).—Private company. Registered March 27th. Capital, £10,000 in £5 shares. To acquire the business of electricians carried on by the Ballymoney Gas Co. The subscribers (each with one share) are:—T. Taggart, Ballymoney, solicitor; J. Hanna, Ballymoney, house furnisher; W. McClure, Ballymoney, grocer; J. Young, Ballymoney, timber merchant; S. Agnew, Ballymoney, baker and grocer; J. T. Taylor, Ballymoney, draper; S. J. Crombie, Ballymoney, draper; S. Todd, Ballymoney, grocer. First directors: T. M. Green, T. Taggart, J. B. Hamilton, J. Hanna, Sen., W. McClure, J. Young, R. Mellroy, G. Todd, and P. J. O'Kane. Solicitor: J. B. Hamilton, Ballymoney, Co. Antrim.

P. J. Driscoll & Co., Ltd. (154,045).—Private company. Registered April 2nd. Capital, £2,000 in £1 shares. To acquire the business of an electrical engineer carried on by P. J. H. Driscoll at 33, d'Arblay Street, London. The subscribers (each with one share) are:—P. J. H. Driscall and J. Kennelly, both of 33, d'Arblay Street, London. First directors: P. J. H. Driscoll, J. Kennelly, and S. Hall. Registered office: 33, d'Arblay Street, London.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wiring, Ltd. (138,072).—Capital, £2,500 in £1 shares. Return dated December 31st, 1918. 100 shares taken up; £100 paid. Mortgages and charges: Nil.

Westminster Electric Supply Corpn., Ltd. (27,061).—Capital, £2,000,000 in 200,000 ord. and 200,000 4½ per cent. cum. pref. shares of £5 each. No annual return has been filed since March, 1918, but a list of allotments shows a further 37,982 ord. shares allotted, payable in cash, between February 19th and March 18th, 1919. (To March, 1918, 110,000 of each class had been issued and fully paid. £240,300 mortgages and charges were outstanding at the same date.)

CITY NOTES.

Waste Heat and Gas Electrical Generating Stations, Ltd.

Mr. G. S. Newall presiding at the annual meeting, on March 31st, said that the construction of the new power station at Horden was proceeding satisfactorily, and it should be in operation at the end of the year unless unforeseen delays occurred. The new gas engine at Weardale had been working from time to time for some weeks, but, owing to several adjustments having to be made, which were to be expected with an entirely new design of plant, it had not yet been put into commercial service continuously. The records up to the present of the performance of the engine showed that it would quite come up to expectations as regards efficiency, and would prove much more economical than the present steam-boiler plant. All the plant in the power stations had been maintained in good and efficient running condition; but owing to various causes arising out of the war, such as less efficient working of blast furnaces, they had not had so much waste heat placed at their disposal during the year, and this had caused a diminution in the electric power generated, with a consequent reduction in revenue. The plant at Teesbridge power station was out of commission throughout the year, but the repair was completed, and it was again in operation and working satisfactorily. With regard to the sum of £5,000 set aside last year for experimental work, the expenditure up to the end of the financial year was £2,278. The experiments had in view the more efficient utilisation of coal, and he was glad to say that, so far as they had gone, they were assured by their engineers and by the power company in conjunction with whom they were carrying the experiments out, they had proved satisfactory. Proposals were being considered with a view to trying the experimental plant on a large scale. He thought it was most important that the company should devote a sum of money each year for experimental purposes. For the experiments mentioned above, if carried out on a larger scale, they proposed to contribute a further sum; of course, anything which would tend to the better utilisation of waste heat would have their greatest support. Certain proposals had lately come before the directors for the installation of a further station for the utilisation of waste energy; they were being considered, but as no definite decision had been arrived at, he could not report on the matter in more than a general way. The profits for the year showed a reduction of £2,085, as compared with the previous year.

Chelsea Electricity Supply Co., Ltd.

At the annual meeting, on April 2nd, Mr. W. R. Davies, the chairman, said that the statement for 1918 was the least favourable that had been presented for a long time past. Compared with 1917 the sales of current had fallen by £2,573, and the profit on installation work by £896. On the other hand, property rental was £440 better, and meter rentals had risen by £126; on balance the receipts were lower by £2,904. The reduction in sales was due entirely to the onerous restrictions rightly imposed by Government, and was a matter which would right itself when restrictions were removed. No other electricity company had been so hard hit in this matter as they had. They supplied a high-class residential area, and had suffered as much from the almost total cessation of social events among the upper classes and the entire absence of a London season as from Government restrictions. With the return of anything like normal conditions the credit side of the revenue account would show a marked recovery. The expenses were principally responsible for the poor showing of the revenue account; they had risen by £5,840. Fuel had cost £280 more for a sale of about a quarter of a million fewer units; repairs were £2,600 higher, and wages and salaries were over £2,600 more; rates £412 more, and half-a-dozen other items had together increased by about £800. The total of these items was about £6,780, and after deducting a saving of £858 in income tax and other small reductions

there was a net increase in working expenses of £5,840. The speaker was not anxious as to the future. Social life in London would in time renew most of its old activities; they could look for some amelioration in the cost of, at least, oil fuel; the charge of nearly £1,500 for allowances to employés on military service would disappear, and repairs, which had been high during the year under review, would become normal again. The principal danger, the continued increase in wages, which would show a further rise for 1919, had at last received a check, as recent demands for a still further increase had been refused by the Arbitration Board, and although 1919 might show no improvement over 1918, they might look for generally improved results at no distant date.

British Columbia Electric Railway Co., Ltd.

Mr. G. P. Norton presided at the annual meeting held last week. In the absence of the chairman, a speech which he had written was read. He said that the report before them was the most encouraging they had had since the outbreak of war. The total income was £91,755 better than for the previous year. The company's reserves were large and placed it in a strong position, but those funds for the most part, had been accumulated as a provision for depreciation, sinking fund, and renewals incidental to such a property. A very large proportion of the plant was erected during the four or five years immediately preceding the war, with the result that few actual replacements had been absolutely unavoidable during the past four years, and the provision for depreciation set aside each year had therefore accumulated. The replacements would be necessary now, and as time went on, and the reserves accumulated could not be considered as more than sufficient to provide for the regular wastage. The increase in gross earnings was attributable to the more prosperous conditions which existed in the cities served by the company resulting largely from the extensive programme of shipbuilding which was in progress during the year. Referring to the strike of July, the chairman said that the company was utterly unable to pay the wages asked for by the men unless revenue could be increased. The revision of fares was permitted, and the wages demanded were agreed to. After referring to the importance to the company of the decision of the Provincial Government to establish a Public Service Commission with powers to revise and fix rates, the chairman stated that if British Columbians desired to see the natural resources of their country developed, and new industries established, they must have capital by offering guarantees of safety and liberal inducements to investors.

German Companies.

The Kabelwerk Duisburg A.G., of Duisburg, records net profits of £45,000 for 1918, as contrasted with £80,000 in the previous twelve months. Notwithstanding this reduction the dividend recommended is at the rate of 16 per cent., as in 1917, together with a bonus of 9 per cent., as in the preceding year.

The directors of the *Ver Isolatoren Werke A.G., of Berlin-Pankow*, report that a substantial part of the stocks suffered depreciation through the sudden cancellation of Army orders, and the financial results in 1918 would have been further diminished if abundant allowance for depreciation had not been made formerly. After setting aside £3,000 for depreciation, as compared with £15,000 in 1917, the accounts show net profits of £6,300, as against £12,000 in the preceding year, and the dividend is at the rate of 10 per cent. on the share capital of £50,000, this contrasting with 20 per cent. in 1917.

The Hamburger Hochbahn A.G., of Hamburg, reporting on the past year, refers to the conclusion of an agreement with the State of Hamburg in July, 1918, whereby the latter transferred its rights in the superstructure of the railway to the company in return for "B" shares of the nominal value of £2,431,000, with a share in the profits as from July 1st in that year. The company had also absorbed the undertaking of the Hamburg Tramways Co., but the transfer of the Alster shipping services to the company had not yet been carried out; nor had that of the Hamburg-Altona Railway Co.; whilst the working of the Waldorfer (steam) line had not yielded any profits. After transferring £30,000 to the renewal fund, as against £20,000 in 1917, the amounts exhibit net profits of £114,000, as compared with £47,000 in the preceding year. A dividend at the rate of 6 per cent. has been declared on the £750,000 of "A" shares, and at the rate of 5 per cent. on the "B" shares for six months.

The Grosse Berliner Strassenbahn A.G., of Berlin, which absorbed the company's four subsidiary tramway undertakings in Greater Berlin in 1918, experienced a considerable increase in revenue from this fact, and from the higher fares introduced last May and the reduced transport facilities on the city railway. The total receipts amounted to £5,005,000, as compared with £3,064,000 in 1917, and the total expenses were £3,096,000, as against £1,970,000, or 61.89 and 64.38 per cent. respectively. After apportioning £660,000 for renewals, as contrasted with £440,000, and writing off £92,000 for depreciation, as against £44,000, and making other allocations, the accounts show net profits of £476,000, as compared with £211,000 in the preceding year. The directors recommend a dividend at the rate of 7½ per cent., as against 4 per cent. in 1917. It is calculated that the introduction of the 8-hours' day, and further increases in wages, will involve an additional charge of £2,000,000 in the present year.

The report of *Voigt & Haeffner A.G., of Frankfort-on-Main*, referring to the year 1918, states that the transfer from war to peace work took place comparatively easily. It would have been possible further to have increased the production if the scarcity of coal and of other raw materials had not imposed limits on the output. After allocating £24,000 to depreciation, as compared with £34,000 in 1917, the accounts indicate net profits of £103,000, as against £170,000, and a dividend of 18 per cent. has been declared on the share capital of £250,000, as compared with 25 per cent. in 1917. At the general meeting on March 26th, it was mentioned that it was difficult to continue manufacturing owing to the lack of raw materials and transport difficulties, whilst the increased demands of the workmen and staff raised further obstacles. The prospects were very dark and considerably less favourable than had appeared from the volume of orders on hand, so that a heavy decline in the results would have to be reckoned with, especially as sale prices could not keep pace with the growing burdens, and the company had to adhere to the prices prevailing in the world's markets.

Northern General Transport Co., Ltd.—The gross traffic receipts for 1918 show a considerable increase, but operating costs advanced substantially, due to rises in wages and materials, and fares had again to be raised. The company has a fleet of 26 motor omnibuses, and others are on order for re-opening certain routes. The company's holdings in the Gateshead, Tynemouth, and Jarrow electric traction companies stand in the books at a cost of £398,982, and the dividends and interest for 1918 were £26,825. These three concerns set aside for reserve and renewals during the year £22,667, bringing the funds up to £219,738. The traffic receipts (less working expenses) of the Northern General Co., and the dividends and other revenues, were £45,863, against £37,555 for 1917. After providing for administration expenses, £3,327 for loan and debenture interest, £5,189 to renewals, and adding £6,624 brought forward, £1,584 is put to debenture redemption fund, 6 per cent. is paid on the preference shares, and 8 per cent. on the ordinary, leaving £12,565 to be carried forward.

West India Electric Co., Ltd.—The report for 1918, which was adopted at the meeting held at Montreal on March 12th, showed that notwithstanding strenuous war conditions and high costs of wages and material and of freight rates from New York to Jamaica, there had been improvement over 1917, owing to the returning confidence of the public and the greater prosperity of the island. Gross earnings, $294,725, an increase of $7,513. Total operating expenses $155,238, decrease $3,952. Net earnings $139,487. Net income $89,602, or 11.20 per cent. on the capital stock, transferred to credit of surplus account. The receipts for current sold for lighting and power showed a healthy state prevailing in that part of the business, in which there was still room for expansion. Four quarterly dividends distributed amounted to $40,000. The lighting system at Kingston, St. Andrew, and Spanish Town had been extended, and new passenger car equipment and gates had been installed in Dam. The hydraulic station gave satisfactory service throughout the year in consequence of a steady rainfall.

Marconi International Marine Communication Co., Ltd.—At an extraordinary meeting called for April 16th, a resolution will be submitted increasing the capital by the creation of 900,000 new shares of £1 each. This will make the capital £1,500,000. The directors wish to provide for probable requirements consequent upon the growth of the business and contemplated capital outlays. It is proposed to offer to the shareholders 600,000 shares at par in proportion to their holdings. The remaining 300,000 shares will be for issue at some future time. "The directors contemplate that at the ordinary general meeting which will be subsequent to the issue (if approved) they will be in a position to recommend upon the then issued capital the payment of the same dividend as was recommended by them and approved by shareholders at the last ordinary general meeting."

Folkestone Electricity Supply Co., Ltd.—The profits for 1918 have been seriously affected by the continued advance in fuel and labour costs. Though the charges for current have been further increased the receipts from sales show a decrease due to the heating and fuel restrictions. 168,497 lamps (8 c.p.) supplied at December, an increase of 3,190. Including the receipts from hired installations, the profit on revenue for the three undertakings was £11,402. After adding £2,643 brought forward, also interest on investments, and allowing for debenture and preference interest, £4,572 is put to depreciation, and 5 per cent. dividend (less tax) on the ordinary shares is to be paid, leaving £965 to be carried forward. Units generated, 2,164,096; units sold, 1,493,944; used on works, 369,872; not accounted for, 300,280.

Lima Light, Power & Tramways Co.—Dividend 1½ per cent.

Bombay Electric Supply & Tramways Co., Ltd.—Dividend on the ordinary shares at the rate of 14 per cent. for the half-year ended December 31st, together with a bonus of 2 per cent. for 1918.

Wood & Cairns, Ltd. (Edinburgh).—Dividend of 10 per cent. on both the ordinary and preference shares for the past year.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

International Light & Power Co., Ltd.—£396,200 5 per cent. first mortgage debentures of £100 each, within Nos. 1 to 4,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—500,000 additional ordinary shares of £1 each, fully paid, Nos. 797,682 to 1,297,681.

General Electric Co., Ltd.—80,000 additional 6½ per cent. cumulative preference shares of £10 each, fully paid (Nos. 70,001 to 350,000).

Marconi International Marine Communication Co., Ltd.—600,000 shares of £1 each, fully-paid (Nos. 1 to 600,000).

Telegraph Construction and Maintenance Co., Ltd.—37,350 additional shares of £12 each, fully-paid (Nos. 37,351 to 74,700).

New York Telephone Co.—The report for the seven months ended July 31st last, from which date the Government assumed control, states that the telephone revenue amounted to $38,606,799 and telephone expenses to $31,741,945, net telephone earnings being $6,864,854; dividend and interest yielded $3,202,367 and miscellaneous earnings $421,339, making total net earnings $10,488,561; interest absorbed $2,916,782, there being a balance of $7,571,778. Dividends of 8 per cent. required $5,000,000, so that the balance to surplus was $2,571,773. On December 31st there were 1,522,720 stations in the system directly operated by the company and its local connecting companies, an increase of 79,332. Including the associated and their connecting companies, constituting the Eastern group or division of the Bell system, there were in service at the end of the year 2,706,459 stations, an increase of 140,546 stations.—*Financial Times.*

American Telephone & Telegraph Co.—The report for 1918 states that the net earnings were $54,293,016. Interest charges were $10,391,694, and the dividends at the regular rate of 8 per cent. per annum were $35,229,698. Of the resulting balance $5,000,000 was appropriated for contingencies and $3,671,622 added to surplus. Investment in associated companies increased $33,084,043, and permanent plant increased $11,300,037, current assets increased $5,165,696, and cash increased $8,611,501. The total indebtedness increased $43,285,851 during the year. There was a total increase in assets of $58,161,278, against which was a net increase in capitalisation and indebtedness of $49,574,465, showing a net improvement in the company's financial position of $8,586,813 which is represented by the increase of that amount in surplus and reserves.—*Financial Times.*

Wycombe (Borough) Electric Light & Power Co., Ltd.—The report for 1918 shows that the connections increased by 113 KW. to 2,842 KW. The demand for power for munitions necessitated running the whole plant at its fullest capacity. Repairs have therefore been impossible, and serious breakdowns have occurred, and the supply has had to be largely given from the older and less efficient plant. This has largely increased the working costs, and entailed large reduction in profit. Additional plant is to be installed at an early date. Profit for 1918 £4,152, against £6,944 for 1917. Interest on debentures and outstanding accounts, £3,012; adding £747 brought forward, £1,888 is available. Of this, £1,500 is to be placed to reserve for renewals, and £388 is to be carried forward.

Montevideo Telephone Co., Ltd.—Resolutions are to be submitted to increase the capital from £160,000 to £220,000 by the creation of 60,000 new ordinary shares of £1 each, and to capitalise £57,963 of the undivided profits and distribute it by the allotment of one new ordinary share for every four preference shares held and one new ordinary share for every two ordinary shares held; and to convert the preference shares into ordinary shares.

Minehead Electric Supply Co., Ltd.—The difficulties of the year reduced the lighting units, and added to all costs, but power units sold satisfactorily increased. Profit after paying debenture interest £826, plus £39 brought forward. Preference dividend, £482; 5 per cent., less tax, on ordinary, £93; depreciation and reserve, £253 (making it £6,300); carried forward, £37. Units generated 298,431; units sold, 216,420; used on works 25,185; not accounted for 56,826.

Bromley (Kent) Electric Light & Power Co., Ltd.—During 1918 connections increased from 4,771 to 4,854 KW. Profit on trading was £7,744, against £9,645 for 1917. Debenture interest, &c., absorbs £2,938. There was brought forward £1,599. Dividend 4 per cent. for the year; £2,000 to renewal reserve; £1,404 carried forward.

Eastern Telegraph Co., Ltd.—Though the accounts cannot be ready at the usual time, data so far received shows that the net earnings for 1918 justify the usual distribution. A further payment on the ordinary shares of 1½ per cent. and a bonus of 2 per cent., making 8 per cent., free of tax, are announced.

Eastern Extension, &c., Telegraph Co., Ltd.—Fourth dividend payment of 3s. per share, and a bonus of 4s. per share, making 8 per cent., free of tax, for the year.

Middleton Electric Traction Co., Ltd.—Dividend of 5 per cent. (5s. per share) on preference shares, bringing the dividend up to July, 1918; £4,560 for repairs and maintenance; £5,000 as provision for renewals; £1,000 to reserve; £2,429 carried forward.

Fuller Accumulator Co., Ltd.—Interim dividends on both the preference and ordinary shares at the rate of 8 per cent. per annum.

Fullers' Carbon & Electrical Co., Ltd.—Interim dividend on ordinary at rate of 8 per cent. per annum.

Fullers' Wire & Cable Co., Ltd.—Interim dividend on preference and ordinary shares at rate of 8 per cent. per annum.

W. T. Henley's Telegraph Works Co., Ltd.—Final dividend on the ordinary shares 2s. 6d. per share, less income tax, making with the interim dividend of 6d. per share paid in September, 3s. per share for the year.

Indo-European Telegraph Co., Ltd.—Final dividend for 1918 22s. 6d. per share, making a total of 7 per cent. for the year, also a further distribution of 30s. per share, free of tax.

Mirrlees Watson Co., Ltd.—Dividend 10 per cent., and a bonus of 2½ per cent., both less tax, £20,000 to reserve, £8,141 carried forward.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Dividend on ordinary shares for half-year 1s. 6d. per share, making 2s. 6d. per share for the year, free of tax up to 5s. in the £.

STOCKS AND SHARES.

Tuesday Evening.

"Strength in idleness" would form a very fair description of many of the markets round the Stock Exchange. Rises in War Loan and gilt-edged stocks have assisted the general tone not a little. More satisfactory news from Russia helped to put a brighter complexion upon matters in that chaotic country. Relief from fears of dearer money have encouraged investment. A little flood of new issues is held back until after Easter; those which have recently been made received in most cases a distinctly favourable reception.

Now that the Treasury Regulations are being relaxed in various directions, it may be expected that various share-splitting schemes—hung up during the war—will make their appearance. This may have something to do with the strength of General Electric ordinary, the price of which has moved up to 17¼. It is well known that the directors are willing to split the shares into a denomination more marketable than £10 nominal. Possibly, too, the Telegraph Construction Co., with its unusual £12 shares, will propose something of the same kind. Without a doubt, the £1 share makes for popularity and is more easily handled than one of £10, or even £5, and a ready market in its shares is a useful asset to most industrial companies.

Amongst new issues of the near future will be that of 200,000 8 per cent. participating preference shares in Fuller's United Electric Works, Ltd., and rumour hints at a possible new issue of ordinary shares in the Edison Swan, details of which may be expected before long. The new preference shares offered last week by the Midland Power Distribution Co. were quoted ⅛ to ¼ premium before the allotments came out. Dealings could not take place, naturally, but there was a declared buyer before the market started in the shares. Vickers novel plan of offering shares in "blocks" may be followed in other cases if it should prove popular with the shareholders, to whom it is addressed. In passing, it may be observed that if Vickers were to amalgamate with, or absorb, all the companies that gossip links it with, the electrical manufacturing industry would soon hold but a single name.

Electricity Supply shares are a quiet market, and for the next two or three months it can hardly be supposed that conditions will alter much from week to week. How the companies fared during the war period can be succinctly shown by tracing the dividend record over the past six years. A brief table brings out these interesting figures:—

Ordinary Share.	1913.	1914.	1915.	1916.	1917.	1918.
Brompton	10	10	10	9	10	8
Charing Cross	6	5	5	5	4	4
Chelsea	5	5	4	3	5	3
City	10	9	8	8	8	8
County	7	7	7	7	7	7
Kensington	9	9	7	6	7	6
London	3	4	3	0	0	0
Metropolitan	4¼	3¼	3	3	4	5
St. James's	12	10	8	8	9	10
South London	5¼	5	5	5	5	5
South. Met.	0	0	4	4	6	6
Westminster	10	9	7	7	9	8

Out of the dozen companies, the Metropolitan and the South Metropolitan are the only two which have advanced their dividends since 1913. The County of London has maintained a regular 7 per cent. throughout the six years. The other nine show declines ranging from ¼ per cent. in the case of South Londons to 3 per cent. in Kensingtons and Londons, though it should be added that the latter has just paid its full 6 per cent. on the preference, against 5 per cent. in 1917. Seeing what all the electric supply companies have had to put up with during the war, the above record can hardly be regarded as aught but satisfactory. No chance for profiteering in electric light, anyway.

The telegraph market keeps firm, the feature here being

the boomlet in Marconis. At length the Marconi Marine secret is out of the bag, and the company is recommending an increase in the capital that will give share for share, at £1, to proprietors. A dividend of 15 per cent.—the same as before—is declared. Upon this handsome bonus, Marines jumped to 4 13/16, and Marconis to 5, the preference also rising to 4¼. Profit-taking reduced Marines to 4 9/16, but the market remains hard. Americans are neglected at 29s. 6d., but Canadians, on a widespread tip to buy for 20s., improved to 16s. 3d.

Home railway stocks are inclined to brace up a little in sympathy with the strength of investment securities. Districts, however, have lost a point at 23½. The City & South London Railway is proposing to enlarge its tunnels, and to borrow up to one and a half million pounds, the latter by the creation of second debenture stock, carrying 5 per cent. interest. During the extended period of construction, the company also asks for power to make up to 5 per cent. per annum until 1924 dividends on the preference capital issued prior to the passing of the Act of 1913. Foreign issues are quiet; some demand has occurred in Anglo-Argentine Tramways 5 per cent. debenture stock. Various Indian tramways shares are better. United Electric of Montevideo debenture stock at 74¼ is 1½ to the good. Mexicans remain quiet, and Brazil Tractions eased off a trifle after the recent rises.

British Aluminiums have weakened 1/16, and Siemens are ¼ lower at 6⅝. Telegraph Constructions have also gone back. British Insulated ordinary, on the other hand, are strong at £2, and other manufacturing shares show a firm front. The rubber market is dull in consequence of a fall in the price of the raw product to a shade below a florin per lb. The armament group keeps steady, and the lifting of the Labour cloud has had a strengthening effect upon iron, coal, and steel varieties.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 8, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	7½	—	£6 8 0
Charing Cross Ordinary	4	4	5¾	—	5 14 4
do. do. do. 4½ Pref.	4½	4½	6¾	—	6 13 4
Chelsea	5	5	8¾	—	4 1 1
City of London	8	8	11½	—	6 14 8
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10¾	—	6 11 0
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	7	6	5½	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	5	6	8¾	—	7 14 10
Metropolitan	4	5	8½	—	7 13 10
do. 4½ per cent. Pref.	4½	4½	6¾	—	6 16 6
St. James' and Pall Mall	9	10	7½	—	7 0 4
South London	5	5	6¾	—	6 19 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅞	—	6 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. T l. Pref.	6	6	99½	—	6 0 7
do. Def.	1½	33/6	21¾	—	7 13 6
Chile Telephone	8	8	7⅞	—	5 8 6
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10¾	—	5 14 8
Great Northern Tel.	22	22	31	—½	7 2 0
Indo-European	13	13	87½	—	5 12 0
Marconi	20	20	5	+ ⅛	4 0 0
Oriental Telephone Ord.	10	15	2⅞	— 1/16	6 3 0
United R. Plate Tel.	8	8	7¼	— ⅛	*5 1 7
West India and Panama	1/3	1/3	1⅛	— 1/16	*3 17 0
Western Telegraph	8	8	15½	—	*4 15 10
HOME RAILS.					
Central London Ord. Assented	4	4	6¾	—	6 8 0
Metropolitan	1	1½	26¾	—	4 14 7
do. District	Nil	Nil	23¾	—1	Nil
Underground Electric Ordinary	Nil	Nil	8⅝	—	Nil
do. do. "A"	Nil	Nil	9⅜	—	Nil
do. do. Income	4	5	94½	—	*5 5 10
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅜	—	6 11 4
Anglo-Arg. Trams. First Pref.	5¼	Nil	8½	—	—
do. do. 2nd Pref.	—	—	3½	—	—
do. do. 5 Deb.	5	5	67½	+1	7 8 5
Brazil Tractions	—	—	56	— ½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 0 0
do. do. Preferred	Nil	Nil	40	—1	Nil
do. do. Deferred	Nil	Nil	41	—	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds	Nil	Nil	52	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	68	+1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	22	—	4 0 0
British Aluminium Ord.	10	10	14⅜	— 1/16	5 16 3
British Insulated Ord.	25	12½	2	+ ⅛	6 5 0
British Westinghouse Pref.	7½	7½	2½	+ 1/16	6 3 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5½	—	6 9 10
Castner-Kellner	25	20	8½	—	6 3 1
Edison-Swan, "A"	—	—	1⅞	+ 1/16	7 5 6
do. do. 5 per cent. Deb.	4	5	75½	+1	6 12 3
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6½	10¾	—	6 5 4
do. Ord.	15	15	17⅝	+ ⅛	*5 12 0
Hanley	25	25	2⅜	—	5 5 ½
do. 4½ Pref.	4½	4½	6	—	5 19 6
India-Rubber	15	15	16⅜	— ⅛	*5 10 3
Siemens Ord.	—	10	6⅝	— ⅛	*7 11 0
Telegraph Con.	20	20	24	— ⅛	5 0 0

Dividends paid free of Income Tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	...
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	„	£78	..
a Bisulphide of Carbon	„	..	..
a Borax	„	£43	..
a Copper Sulphate	„	£42	£5 dec.
a Potash, Chlorate	per lb.	1/9	..
a „ Perchlorate	„	1/9	..
a Shellac	per cwt.	£11	30s. dec.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	„	£31	£2 dec.
a „ Lump	„	£23	£2 dec.
a Soda, Chlorate	per lb.	11d.	..
a „ Crystals	per ton	£70	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2' to 12' basis)	per lb.	11¼d.	..
c „ Tubes (solid drawn)	„	1/3½ to 1/2½	½d. inc.
c „ Wire, basis	„	1/-	..
c Copper Tubes (solid drawn)	„	1/4	½d. inc.
g „ Bars (best selected)	per ton	£114	..
g „ Sheet	„	£114	..
g „ Rod	„	£114	..
d „ (Electrolytic) Bars	„	£84	30s. inc.
d „ „ Sheets	„	£101	..
d „ „ Wire Rods	„	£94	30s. inc.
d „ „ H.C. Wire	per lb.	11¾d.	½d. inc.
f Ebonite Rod	„	3/-	..
f „ Sheet	„	2/6	..
n German Silver Wire	„	2/6	..
h Gutta-percha, fine	„	11/-	..
h India-rubber, Para fine	„	2/5½	½d. inc.
i Iron Pig (Cleveland warrants)	per ton	Nom.,	..
l „ Wire, galv. No. 8, P.O. qual.	„	£40	..
g Lead, English Pig	„	..	..
a Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e „ „ „ medium	„	5/- to 10/-	..
e „ „ „ large	„	12/6 to 25/- & up.	..
d Silicium Bronze Wire	per lb.	1/4	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	„	£236 to £236	..
n „ Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespears.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Water Softening.—In his memorandum for the year 1917-18, Mr. C. E. Stromeyer, chief engineer to the Manchester Steam Users' Association, gives special attention to the subject of water softening, from both the chemical and the physical aspects. He considers that owing to the incompleteness of the chemical reactions, the ordinary softening processes cannot reduce the real hardness below 2·4 degrees. The "time factor" is of importance; the reaction is not instantaneous, and the necessary intimacy of mixture can only be attained if sufficient time is allowed, though it may be hurried up by mechanical agitation. The reaction is also facilitated by heating. For rapidity of filtration, it is desirable that the particles of sediment shall be as large as possible, so that a coarse filtering medium can be used; coarseness is secured by slowness of reaction, high temperature, and violence of agitation. Eddying currents in settling tanks should be avoided as far as possible, and methods are described with this object in view. In one case the water is passed at a very low velocity across a wide tank, the effluent from the surface being free from particles of sediment. The Association's chemist has examined a number of water softeners used by the members, and finds that in most cases the chemical reaction is not completed until the water reaches the settling tank, or even the boiler. In some softeners the flow of the water is 10 times as fast as in others, with the result that in the former the quantity of sediment carried over with the treated water is about a million times as great as in the latter.

The combination of salt and soda, together with dissolved air, tends to cause pitting of boiler plates; good preventatives are a slight excess of soda, or the addition of tannin solutions, but the tannin must be added to the feed *after* the softening process. The use of barium aluminate is almost as effective as distillation, leaving no residual hardness; but the barium salts are poisonous. What may happen to a boiler when the water supply is neglected, was exemplified during 1917 by the collapse of the furnaces in two boilers through overheating; it was found that sulphate of soda had accumulated to such an extent that the boilers had been working with melted Glauber salts—a bucket of boiler water when cold turned to a solid mass of crystals.

External corrosion, a furnace fracture due to working steel at a "blue" heat, and the failure of screw bolts owing to excessive stresses set up by slight differences in pitch between the nut and bolt threads, are also dealt with in the memorandum.

THE PRESENT ELECTRICAL OUTLOOK IN CANADA.

By A. S. L. BARNES, A.M.I.E.E.

(*Concluded from page* 390.)

If the Dominion is to make the rapid strides that are being predicted for her by so many prominent men, then her people will be prosperous, and will require many things which British manufacturers should be able to supply if they would go the right way about it.

Proper representation over here is necessary, and stocks of spare parts will be, in many cases, essential; firms at home must not forget that there are two powerful and firmly-established competitors here, viz.:—The Canadian General Electric Co. and the Canadian Westinghouse Co., with large works in Canada itself and with means of obtaining or quoting or practically anything electrical through their connections with the immense works bearing similar names in the U.S.A.; besides this, there are other firms manufacturing all kinds of electrical devices and fittings specially adapted to the Canadian markets.

So far as generators, motors, transformers, &c., go, as well as meters, instruments, switchgear, &c., British manufacturers will not find Canadian buyers restrict them specially to any particular type, but care should be taken that the ratings of generators, motors, and the like are stated in terms comparable with those of the American Institute of Electrical Engineers, which are taken as the standard here.

For example, if the British rating for an electric motor be such that a greater temperature rise is allowable than is the case here, resulting in what is called a 7½-H.P. motor here being rated at, say, 10 H.P. in England, then, if a manufacturer desires to succeed here, he must conform to the standards obtaining here, and not to those in England; in other words, his 10-H.P. motor must be sold as a 7½-H.P. motor, which will put it on the same basis as motors made on this continent. This will deprive the enterprising salesman of an apparent advantage, but will undoubtedly pay in the long run, as, if the motor be rated at the higher figure, the user will certainly overload it, as he has been accustomed to do with the American 7½-H.P. motor, with disastrous results for the motor, and worse for the reputation of its maker. The writer has been informed on what he believes to be very good authority that the foregoing represents actual experience in the case of at least one British firm.

So far as fittings and materials for wiring generally are concerned, the market for these is standardised by the specifications and requirements of the National Electrical Code (the book of rules of the Fire Underwriters), and manufacturers will find it practically essential to comply with the code before entering the market at all.

All fittings, materials, &c., permitted for use under this code must be tested at the Underwriters' Laboratories in Chicago; there are, however, in London representatives to whom British firms can apply for information, and, to some extent, for approval.

In the Province of Ontario the Hydro-Electric Power Commission of Ontario has jurisdiction in such matters; and although at present all fittings, devices, and materials approved by the Underwriters' Laboratories, receive the general approval of the Commission, yet the right to approve of things not accepted by the Underwriters, and to reject things approved by them, is vested in the Commission, to be exercised at its discretion.

The Commission maintains a large and efficient laboratory, the equipment of which is constantly being added to, for carrying out all manner of mechanical, electrical, physical and chemical tests, and at the present time large numbers of new devices and fittings are being submitted for test by manufacturers, before being put on the market.

British firms wishing to enter the Ontario market should certainly have their products definitely approved by this Commission before going far with their plans, otherwise they are liable to find themselves shut out of the part of the Dominion having the greatest trade possibilities.

It may not be generally known that the British Board of Trade has comparatively recently appointed Imperial Trade Commissioners and Imperial Trade Correspondents in the Overseas Dominions.

Canada has two of the former, one in Montreal and one in Toronto, and several of the latter in various parts of the country.

The writer, some little time ago, discussed the marketing of United Kingdom electrical goods in Canada with Mr. F. W. Field, the British Government Trade Commissioner in Ontario. Mr. Field, who reports to the Department of Overseas Trade (Development and Intelligence) in London, has his headquarters at central and commodious offices in Toronto.

The following gives Mr. Field's views:—

"Except in isolated cases, United Kingdom firms making electrical appliances and equipment do not appear to have made a careful survey of the Canadian market, or any serious attempt to compete with their aggressive competitors here, chiefly the United States."

"After the war, there will undoubtedly be a substantial demand for electrical goods in Canada, and particularly in Ontario, the area in which I represent the British Government's Department of Overseas Trade. The extensive programme of the Hydro-Electric Power Commission of Ontario is a significant omen of the probable demand."

Four of the outstanding points with regard to the United Kingdom in this market are:—

"(*a*) Quality of the goods.

"(*b*) Style and finish.

"(*c*) Service and spare parts.

"(*d*) Selling.

"The quality of the United Kingdom goods sold here, speaking generally, has been excellent."

"The style and finish of electrical appliances has been, in the majority of cases, decidedly inferior to those of United States goods. This market demands attractive styles and finishes for appliances, and the United States manufacturers do everything possible to cater for the demand.

"The conditions and requirements of this market must be carefully studied and followed if success is to be achieved here. The Canadian purchaser must be able to know that if United Kingdom goods are bought, the manufacturers thereof will give the necessary service afterwards from time to time. This applies particularly to machinery, in connection with which arrangements must be made by the United Kingdom manufacturers for supplies locally of spare parts and repairs."

"In short, if the United Kingdom electrical industry will regard seriously the keen competition to be met here, will study the local requirements, and supply what is wanted, then with an aggressive selling organisation, with reasonable prices, and the well-known reputation of United Kingdom goods, there does not appear to be any good reason why British trade in electrical appliances and equipment should not, in due course, make notable strides in this market."

It will be of interest to know that Mr. Field, in his official capacity as British Trade Commissioner in Ontario, visited the ground of the Chippewa power development of the Hydro-Electric Power Commission of Ontario last spring, addressed the convention of the Canadian Association of Municipal Electrical Engineers at Niagara Falls in June, with regard to the origin and purpose of the Trade Commissioner Service, and attended a convention in October, at Toronto, of the Ontario Association of Electrical Contractors and Dealers, in addition to making various reports to his department of interest to the industry.

The business prospects in Canada from all present indications are excellent; some authorities are cautious enough to say that they think that trade will be dull for a little while, but even these men are quite optimistic about the future.

There is much railway work to be done, not only on new lines; during the war, maintenance and repair work have not been carried out on anything like an adequate scale, and a great deal of such work will now be undertaken.

Government and municipal works of all kinds have been held up by the war, and many of these will be started soon, one notable instance being the construction work on the new Willand Canal,* which runs from Lake Erie to Lake Ontario—this is being recommenced now; many industrial concerns have likewise held over a good deal of work of all kinds during the war; shipbuilding, as already indicated, seems to be assured of a good time, and, with food so much needed in Europe, the farmers are practically certain to be fairly prosperous for some time to come.

While no definite electric railway schemes are known to the writer, which are likely to be undertaken immediately, it is hardly to be doubted that there will be a good deal of activity in this line in the next few years.

With the great water power developments now in course of construction at Niagara Falls, Ontario, and the possibilities for immediate extension at Shawinigan Falls, Quebec, it is more than likely that great electrochemical and electrometallurgical industries will be established at such centres, where power will be cheap, and transportation facilities, by either land or water, are good.

The writer heard a criticism from a professor of one of the great Universities here, the other day, regarding British firms; this gentleman remarked that frequently, before the war, when machinery was ordered by the University, the British manufacturer demanded payment before his products left England. This may seem to be good business from the other side of the Atlantic, but it has the decided disadvantage that a University dislikes being treated as if it would not, or could not, pay its bills; and the chances are great that the professors of engineering will speak more sympathetically to the graduates about machinery obtained without difficulty from the U.S.A. than about that obtained from England.

British firms have quite enough handicaps in trading over here, as compared with the United States, without making things worse by creating a bad impression amongst young engineers at the very commencement of their profession; practically all of these men when they leave college go the States to complete their initial training, and thus know next tonothing about British firms and what they can do.

If the responsible heads of some firms at home imagine that the Universities at Montreal and Toronto are only fit to be treated like some petty concern with no standing, the sooner they pay a personal visit to this country, and (to use an Americanism) "get acquainted," the better; there is no more reason for such an attitude towards these great institutions than there would be towards, say, the University of Manchester. No doubt many matters of this kind will be far different now from what they were five years ago.

This is somewhat of a digression. To return to a discussion of business prospects, the different works mentioned above, though mostly not such as would affect electrical manufacturers directly, will undoubtedly do so indirectly, as many electric motors and appliances will be needed for the carrying out of such work, while the general prosperity resulting, will undoubtedly give rise to demands on the part of householders for all manner of electrical goods—this is on the assumption that the good time predicted for Canada in the near future is realised, and there seems no reason to think that it will not be. Some of the Canadian banks are opening branches in South America with a view to extending the country's trade there, and a Government Commission has been sent over to England to secure for Canada as much as possible of the business arising from reconstruction work in Europe; the British Government, according to the daily papers, is placing an order for an immense quantity of timber in Canada, all of which points to a certain degree of prosperity for the country.

The policy of the Institution of Electrical Engineers regarding Canada is rather hard to understand; before the war attempts were made by quite a number of men over here to form a Canadian Section, but the attitude of headquarters in London was very luke warm. Most of such men find it to their interest to join the American Institute, which has several Sections in Canada, and thus gradually lose touch with the Institution at home. If English firms want Canadian business, and surely our Institution would wish to see such business grow, nothing should be done by any section of the electrical community which would jeopardise that trading which Britain should have with this country, but which at present is all too largely in the hands of the United States (see figures *re* imports of electrical apparatus given on page 359).

It is to be hoped that, now the war is over, the Council of the Institution will take a different view of the situation, and that one or two strong "Sections" may be formed over here. The Society of Chemical Industry manages to keep a very active Canadian Section in existence, which is doing very good work indeed. Why the electrical engineers cannot do the same, if suitable steps be taken, is not altogether apparent, unless it be that already it is too late, seeing that the American Institute is firmly established.

In the opinion of the writer, the B.E.A.M.A. also should get its representatives over here to join together for concerted action.

As showing the possibilities of trade in electrical appliances in Canada, the following recently published list is of decided interest.

In Windsor, Ontario, a city of some 20,000 inhabitants, the local Hydro-Electric Department (which purchases power in bulk from the Hydro-Electric Power Commission, of Ontario), sold appliances as shown below:—

	1916.	1917.	1918.
Lamps...	27,833	34,268	29,111
Irons	989	908	1,491
Toasters	164	234	301
Grills	64	109	104
Percolators	21	40	36
Warming pads ...	14	8	13
Vacuum cleaners ...	67	78	79
Washing machines ...	16	44	43
Cooking ranges ...	68	87	95
Fans	132	204	152
Heaters	51	261	253
Hot-plates	16	56	66
Motors, single-phase...	12	11	10
Motors, three-phase ...	9	16	26

In 1915 the merchandise sales were worth $11,050; 1916, $24,931; 1917, $44,793; 1918, $66,243. In addition, it is reported that local retail dealers are also increasing their sales.

No-one, of course, is quite sure what the future holds in store for this country, yet the tone of many of the manufacturers is decidedly cheerful, and, if labour troubles can be avoided, there seems to be no reason to suppose that they will be seriously disappointed.

The personal opinion of the writer is that there is a good opportunity for British electrical trade over here, but advantage should be taken of every possible means of promoting intercourse in electrical matters—the Institution of Electrical Engineers, the B.E.A.M.A., and the firms themselves must all take decisive action tending to the same end—that of keeping up a close connection between electrical men here and at home; furthermore, many existing standards cannot be altered, for they are fixed by common practice, not only in Canada, but in the United States, and nothing but disappointment can be expected if an attempt be made to alter or dodge these standards. It would be a good thing, too, if the English technical journals could find some means of making themselves better known; it is very easy to buy their American contemporaries here, but the average Canadian engineer knows nothing—hardly even the names—of the English ones. One drawback to the English papers from the point of view of the native-born Canadian who has never been to England or to any part of Europe, is that he takes no particular interest in what is going on so far from his own country. In order to attract and hold his attention, it would seem to be essential that there should be frequent, good, descriptive articles of work being done in Canada, and possibly in the United States as well, and other matter with which he may be expected to be familiar. Firms with agencies or branches in this country, advertising in the English papers, should make the fact stand out for the Canadian reader.

* Electrical Review, April 26th, 1918.

Means should also be established whereby at not too great expense materials or machinery might be tested in England by some accredited body satisfactory to Canadian purchasers before shipment; for example, if a large batch of high-tension insulators be ordered, say, from the Ohio Brass Co. in the U.S.A., it is an easy matter to send a man from Canada to watch the manufacture and supervise the tests, in order to ensure that none but good insulators shall leave the factory to fill that particular order; but if these insulators were ordered from England matters would not be so simple, hence the natural tendency here to send such an order to the States, even though sentiment is in many cases in favour of sending it to Britain.

All persons interested in the development of British electrical trade with Canada, in both countries, should be induced to do their utmost to further it, and no feelings of professional aloofness or any kind of jealousies should be allowed to interfere with the carrying out of any practicable, dignified, and honourable scheme which promises any reasonable degree of success; each section of the electrical community must endeavour to do its part, otherwise the whole will suffer, and the present immense disparity between the electrical trade of Canada with England, and that with the United States, will grow even greater, until British manufacturers will have no chance at all here.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

At Newcastle-upon-Tyne, on March 24th, Dr. S. F. Barclay and Dr. S. P. Smith's paper (an abstract of which appeared in our issue of March 7th) was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. Rosen opened the discussion, and spoke of the importance of ascertaining the actual efficiency of a turbo-alternator including load losses; they wanted to measure the magnitude and also to locate the position of the losses.

Mr. E. Fawssett said he knew a case where the stray losses greatly altered according to the load at which the machine was running. Referring to the curves plotted from Pitot-tube readings taken at the opening of a temporary discharge trunk, he said it made him prefer the calibrated method, for there seemed to be serious chances of error in the former method.

Mr. L. H. A. Carr thought the term "stray loss" was rather unfortunate, because there were two types of losses to be considered, one stray loss on no load, and the other only occurred on load, the latter being an incremental loss. Apparently this latter stray loss was different from that in an ordinary turbo-generator, where they had not got so much distortion in the field. It seemed it was possible to overcome some of the loss. It was suggested that anemometer readings of one minute each should be taken; that seemed rather a difficult problem.

Mr. J. R. Beard made some suggestions as to methods of measuring losses. With the calibrated air-temperature method, he did not see why it was not possible to put some cheap resistance in the inner duct and measure the amount of energy that was put in. He suggested that the air might be kept in a closed circuit, and the heat abstracted could be measured. He thought there were more accurate methods of measurement than those described in the paper.

Mr. Carnegie said from personal experience he had been forced to the same conclusion as the authors, namely, that the anemometer was the only convenient instrument available, and suggested the use of an orifice in connection with it. The anemometer had to be used carefully, for if it were subject to any rough usage the results might vary 20 per cent. either way.

Dr. Smith, in reply, said some of the points mentioned would enable them to improve some of the details. The problem of loss was still a very difficult one, and Dr. Barclay and himself were making investigation, but their work was not yet complete.

At Birmingham, on March 5th, the same paper was read and discussed before the South-Midland Centre of the I.E.E.

Mr. R. Orsettich said that three firms at that time were experimenting with measurements of the cooling air as the only reliable method of determining the losses, and that this method was recommended for further investigation. Great credit was, therefore, due to the authors for being the first to publish the result of their inquiries, and for the great accuracy shown in the results of the experiments. A striking fact was the very large figure representing the stray losses. These losses had not been ascertained by direct measurement, nor was it yet quite clear where they took place or to what peculiarity of construction they were due. They seemed to share the nature of copper losses in so far as they were dependent upon the load, but they appeared to be taking place mainly in the iron portions of the machine, and were therefore really iron losses. Some engineers usually put down these stray losses as a multiple of the copper losses, but Mr. Hobart, in the last edition of the "Standard Handbook," stated that a probable and fairly accurate value was obtained if they were taken as equal to one-half of the iron losses.

Mr. R. G. Jakeman thought that the most noticeable feature of the paper was the extreme care that the authors had used in obtaining their results. In fact, it was doubtful whether most people would be able to use such care, and no doubt that was the reason that the accuracy of the anemometer was generally regarded with so much suspicion. The anemometer had improved much of late years, and makers now guaranteed them within 1 per cent. The calibrated air-temperature method appeared to do away with all instruments of precision. As far as it went, however, the paper was not of much use to the manufacturer. It only enabled him to find out the value of the losses after the machine had been built, but did not inform him how to predict those losses so that the manufacturer could guarantee the efficiency in the tendering stage. He hoped the authors would continue their experiments and determine how the stray loss varied with the load, voltage, and speed. One of the slides shown by Dr. Barclay showed that in two machines of the same output the stray loss was 23.5 per cent. and 40.3 per cent. Perhaps by means of the tests mentioned some relation could be found between the stray loss and the stator copper loss.

Dr. M. L. Kahn fully agreed that the most satisfactory method evolved at present to determine the efficiency of turbo-alternators was by measuring the total loss by the air heating method. One precaution seemed not to have been specifically mentioned in the paper. It was essential to run the machine for some time at each particular load on which the efficiency was to be ascertained, so that the temperature could become fairly steady. There seemed to be sometimes a misconception with regard to stray losses; they were often classed with the copper losses in the stator, and expressed by adding a certain percentage to those losses, while they were really to a large extent increased iron losses. That these losses had no fixed relation to the stator copper losses could easily be seen if one considered that by decreasing the copper weight of the stator winding, the stator losses were practically unaffected. If the stator copper losses were based on the ohmic resistance measured on the test bed with direct-current instruments, when determining the efficiency by a summation of separate losses, the actual losses in the stator copper with full alternating current flowing, would be higher, due to the uneven distribution of the alternating current in the conductors. This difference accounted only for a small part of the stray losses, and the difference could be greatly reduced by using stranded conductors for the whole of the windings without affecting the total stray losses in the machine materially. Investigations of these stray losses would be of great value.

Mr. C. V. Peake said that if it were possible to convert the steam consumption of the turbine when running light into actual brake-horse-power, and thus into kilowatts, then the alternator efficiency might be determined by taking the following steam consumptions: (1) Running light and uncoupled. (2) Running light but coupled to alternator, the latter being unexcited. (3) Running light with the alternator over-excited by an amount necessary to balance the drop due to resistance and reactance on the specific power factor. The results obtained by subtracting (1) from (2) would give the windage friction and alternator-bearing losses, and subtracting (2) from (3) would give iron losses.

Mr. F. J. Moffett explained that for many years he had taken an interest in anemometers, and had used an instrument which was calibrated at Kew, and found accurate within 2 per cent. It appeared to him that the method adopted in the paper for measurement of the alternator losses was capable of being adapted to provide a continuous record of a turbo set when in service. If recording instruments to measure the air velocity, air-temperature rise, electrical output of alternator, and steam input to turbine were arranged to all record on the same drum, the various losses could be ascertained at any time by drawing a vertical line on the drum. The Kent steam meter which worked on the Venturi principle, gave fairly accurate readings. From such a combination of records valuable information could readily be obtained as to the condition of the turbine and alternator. Air did not appear to him to be the most effective cooling medium to use for removing the heat due to the various losses. If a gas or liquid were used it would be necessary to conduct the cooling on a closed circuit system. The cooling medium after passing through the air passages of the alternator would need to be cooled by passing through a feed-water heater or similar arrangement. This alone would somewhat increase the total efficiency of generation, as the heat due to the losses would be returned to the boilers in the feed water.

ELECTRIC TRANSPORT VEHICLES.

By C. TUNSTILL OPPERMAN.

(*Abstract of paper read before the* Institution of Automobile Engineers.)

The object of this short paper is to assist in popularising the use of electricity in the transport of goods and thereby saving labour.

Electricity at 1d. per unit, in view of what it can be made to accomplish, bears a remarkably small proportionate cost when compared with the present-day labourer at twenty pence per hour. It will be agreed that in view of the state of the coal industry in the country at the moment, it behoves everyone, from the station engineers down to the man or woman who drives an electric vehicle, to do the utmost in their power to exercise the strictest economy, assisting in the great effort to save both labour and coal.

In the author's opinion there is very little to choose between the vehicles in general use from the point of view of mechanical and electrical efficiency. From tests made some years ago with both front and rear driven wheels, he was unable to find any marked difference in the amount of current required, neither does he find in any of the vehicles on the market much room for improvement.

One point to which attention should be given is the design of a simple change speed gear, to enable vehicles to negotiate hills more readily, for notwithstanding the mechanical loss which this would entail, by such an arrangement the motor would always run at or about its normal speed instead of dropping to about half as is commonly the case now. The saving here alone would go a long way towards compensating for the loss in the gear, and what is of far greater importance, excessive discharges from the batteries would be prevented.

The author feels sure that if central stations were to use electric vehicles more than they do, it would encourage their customers to do the same. The time has not arrived when the author can confidently recommend the use of lighter vehicles for pleasure purposes. The limited distance over which they can be used so often leads to disappointment, and inexperienced persons would run the battery to a standstill.

The crux of the whole question is the type of battery to be used. The author's experience of the ordinary pasted type of battery proves that it is not altogether satisfactory. It is really not a commercial proposition.

Of the pasted type of cells, the Exide is the only one which is being used with any degree of success. It is stated that these batteries have run as much as 25,000 miles before requiring renewal. Further, the manufacturers are prepared to guarantee the life of the battery under certain conditions.

There remains only one other class of battery which could be considered at all useful for the purpose, and that is the Edison nickel and iron battery, which seems to have a very long life.

From the point of view of lightness there is nothing to be gained, whilst the space occupied by the iron battery is very considerably more than that required for the lead one, and the lead battery requires less attention. One very objectionable feature of the alkaline battery is that the salts creep, causing surface leakage and short-circuiting. This deposit has to be removed by steam, and takes much time. Men handling batteries find contact with diluted acid far less objectionable and harmful than contact with caustic potash. Another serious objection to the iron battery is the low electromotive force given. This objection has, the author believes, been removed on the later types. The lead accumulator appears to have considerable advantages in charging.

In the lead cell, material gradually detached from its supporting frame, falls to the bottom of the container and causes a certain amount of short-circuiting, whilst the amount of active material available for useful purposes in the cells becomes daily less, so that in general the number of charges and discharges which the cell is able to stand, is limited to about 150, whilst in the case of the Exide cell already mentioned, they might amount to as many as 300. In the Edison battery the reversibility of the chemical reactions is practically complete, and as far as the author has been able to investigate the matter, the only loss arising is that due to the electrolysis of the water.

In order to increase the distance over which an electric vehicle can be used a boosting charge can be given with advantage. The only trouble is whether the central stations would care to provide a large number of vehicles with a "boosting" charge if called upon to do so at one time.

The author has found it very difficult to obtain detailed figures of actual running costs, but there is no doubt whatsoever that where the journeys made are regular and over known routes from day to day, there is no means so economical as that provided by electricity, and it is quite possible for the user to know within very close limits what his cost per ton-mile will be, and this can be absolutely maintained under guarantee from the makers, both of the vehicle and of the battery.

The comparative costs of electric and horse traction used on dust collection by the Croydon Council showed that the work done by the electric wagon was equal to that of three horses. In this case an Exide Ironclad battery was used, but if an Edison battery were to be installed the cost would be reduced, owing to the decrease in the charge for depreciation.

A well-known firm using the Edison battery, and a fleet of nearly a hundred electric vehicles of 15 cwt., 1 ton, and 2 tons capacity, states that the costs are as follows: battery maintenance, tires, repairs, 2.9d. and electricity 0.775d. per mile run. A large railway company gives the following figures: per annum, 30-cwt. (Edison battery), parcels van, £178 5s., or 4.28d. per mile; 1-ton (Edison battery) parcels van, £159 15s., or 3.84d. per mile; 1-ton (lead battery) parcels van, £199 5s., or 4.78d. per mile; based on 10,000 miles per annum, with current at 1d. per unit, tires at 18,000 miles, and standing charges, with Edison battery, at ten years, and lead battery at 2½ years.

To the user who confines his operations to a large city and its immediate surroundings, there is no method of transport which offers the advantages of the electric system. From an economical point of view it is cheaper than either horses or petrol vehicles.

As an example of the reliability of electric vehicles, the Midland Railway Co. states that out of a fleet of nine 30-cwt. parcel vans, four ran throughout the year 1917 without losing a single day's service, and by the end of the year the machines were two years old and had run 30,000 miles each. It is no uncommon occurrence to find that a set of tires will last upwards of 30,000 miles.

To the user who has long journeys to make, the author can only say that petrol is the only satisfactory form of power to adopt.

In the course of inquiries which the author made in the United States regarding electric vehicles, he was particularly struck with a system of providing batteries in general vogue there, called the battery service system.* By this system the user of the vehicle contracts with the electric supply company for the use of the battery and the supply of energy, payment being made on mileage rate and for the battery service.

A well-organised battery service system would undoubtedly be the best means of providing a big day- and early-morning load for the power station, and would have an enormous influence on the sale of electric vehicles, because it would simplify matters for the user and reduce running costs to a definite known basis.

As to the relative costs of carrying goods by means of petrol or electric vehicles, the author does not think that there can be the slightest doubt that if the routes are regular and well-known, particularly in cities, the cost of carriage by electricity is far and away cheaper than that by petrol.

In conclusion, the author is sure that if central-station engineers will give all the encouragement and assistance in their power to popularise electric vehicles by bringing to the notice of their customers the advantages obtained by their use, they would become far more general, and should more nearly approach the numbers used in America.

Opening the discussion, Mr. F. Ayton (city electrical engineer, Ipswich) congratulated Mr. Opperman, as a pioneer in the development of the electric vehicle, on seeing it brought to a successful issue. The electric was not a competitor of the petrol vehicle; there was room for both. The electric was a short-distance, moderate-speed vehicle, with an immense field of utility in towns; it had had a better chance in the United States, where three years ago there were over 70,000 in use, and fleets of over 100—up to 375, and even 610—were met with. In 1916 the U.S. annual sales were: private, 4,000; commercial, 2,500; industrial, 1,500. The demand for petrol was increasing, and before long the United States would have none to spare for export; it was doubtful whether benzol would be available in sufficient quantity to take its place; and they could conserve the supplies by using electricity. While the electric was a moderate-speed vehicle, experience showed that on the average in traffic it was quite as speedy as the petrol vehicle. In rural areas the mileage range of the electric was uncertain, owing to the widely varying resistances of the road surfaces. As a pleasure vehicle it was very popular in the United States, in urban districts, and electric taxicabs had been successfully adopted at Detroit, the home of the petrol vehicle, Chicago, and Berlin, being much cheaper to run than petrol cabs. There was no trouble nowadays with dust in the gears. After a few years' service there was nothing to choose between the Exide and the Edison batteries; he had 12 heavy-duty vehicles fitted with Exide batteries, and one of them ran for two years and ten months under severe working conditions without renewal. A suitable meter on the vehicle afforded a safeguard against over-discharge of the battery.

Mr. E. W. Curtis (General Vehicle Co., Ltd.) said the petrol

* Elec. Rev. Oct. 5th, 1917, and Aug. 9th, 1918.

men had been too busy to investigate the merits of the electric vehicle, but now was the time to do so. The electric vehicle made friends, and kept them; renewals could be effected overnight, giving 365 days' service a year, and electrical energy at 1d. a unit was equivalent to petrol at 6d. a gallon. Recuperation had been tried, but introduced undesirable complications. The central-station engineers had done heroic work for the electric vehicle, with the help of the Electric Vehicle Committee.

Mr. W. Worby Beaumont said that Mr. Opperman as a pioneer had suffered from the too optimistic claims that were made for the electric vehicle in the early days; whereas it was then a failure for light loads, it was now a success for heavy loads, and was going to do a great deal more than the public realised. The best results were obtained in slow, heavy work with many stops; it did not suit a one-horse man, but gave good results where there was plenty of work for it. Enclosed gears were now available. Change-speed gears should be avoided. There were hundreds of charging stations in this country. The long life of electric vehicle tires was due to the low speed.

Mr. R. A. Chattock (city electrical engineer, Birmingham) said that central station men had to wait for satisfactory vehicles before they could do anything—now they were getting busy, and there would have been big developments but for the war. From 200 to 300 charging stations were available, and they were ready to supply any quantity of energy that might be required. There was no hope for the battery service system until the use of electric vehicles was very much more general; interchangeability was necessary, and the Electric Vehicle Committee was busy with the standardising of batteries and boxes. The lead cell was damaged by short-circuiting, while the Edison cell actually benefited by it; however, in practice there was nothing to choose between them.

Mr. P. A. Mossay (Ransomes, Sims & Jefferies, Ltd.) said that the attitude of petrol vehicle makers had changed as they got better acquainted with the electric vehicle. The gear question had been entirely solved, and no clutch was necessary. A 7-h.p. motor running at 1,800 r.p.m. had an efficiency of 89 per cent., and at 600 r.p.m. it gave 16 h.p. with an efficiency of 80 per cent.; it was suitable for a 3½-ton vehicle.

Mr. Hales (Edison Accumulators, Ltd.) said the electric vehicle had made more rapid progress in the United States than here simply because the Edison battery was introduced there seven years before it came here in 1911; since that date the electric had been successful here also. The Edison guarantee was 60,000 miles or eight years, and the battery had the advantage in weight compared with the lead type. The author's reference to creeping and leakage must have been due to some mistake, as steel containers were used; there was no harm in the deposit, which should be cleaned off with steam once in two months. Mr. Ayton was an expert in the care of lead batteries—what would happen to them in unskilled hands?

Mr. G. C. Conradi (Midland Railway Co.) said there was a great future for electrical transport. In hilly towns a change-speed gear offered distinct advantages, but not elsewhere; the series-parallel controller was preferable. In a fleet of 76 vehicles in his charge, he found that there was no difference between the lead and Edison batteries, provided that the battery was chosen to suit the conditions—the Edison had a higher internal resistance, whilst the lead battery required more skilled attendance. After four years' running, last year eight of his vehicles did not lose a single day. The depreciation of the petrol vehicle increased much faster than that of the electric, and the chance of exhausting the charge of the battery was shown by experience to be about 1 in 2,500.

Mr. C. N. Good (Chloride Electrical Storage Co., Ltd.) said that the author mentioned 300 discharges as the life of the Exide battery; this should be 600, under the two-year guarantee, as was proved by the mileage given, and was probably nearer 1,000 in practice. Whilst a life of two years was guaranteed, it often reached three and a half or four years.

Mr. Ayton, replying to Mr. Hales, said that the battery attendants at Ipswich were quite unskilled, but had no difficulty in attending to the lead battery. Both types of battery were good.

Mr. Mitchell suggested that the scope of the Institution of Automobile Engineers should be broadened to cover all methods of transportation. The electric, like the steam, vehicle had had to force its way to the front; it offered colossal possibilities for the future—all town transport ought to be electric. It was now realised that first cost was not so important as maintenance, and they should employ first-class material and workmanship in the manufacture of electric vehicles. All motor vehicles now appealed primarily to the mass of the public; pleasure was a secondary matter, but still there was a great future for pleasure vehicles.

Mr. Opperman briefly replied to the points raised.

Erith National Kitchen.—The Erith Urban District Municipal Restaurant was to be formally opened yesterday by Mr. T. G. Jones, Director of National Kitchens of the Ministry of Food. The Kitchen is equipped with "Carron" electrical cooking apparatus, and has been constructed on most modern and hygienic lines.

NATIONAL ELECTRICITY SUPPLY.

The report (dated October 14th, 1918) of the Chairmen of the Advisory Council to the Ministry of Reconstruction, upon certain administrative aspects of the electric power supply question, was published last week. The chairmen of the different sections of the Advisory Council in question constituted an informal committee which met each week during the past year to advise the Minister on the most practical methods of approaching the large commercial administrative questions which came before the Ministry to review. They included prominent business men in Sir Henry Birchenough, Messrs. Herbert Gibbs, Lionel Hichens, Ernest Husey, Sir Clarendon Hyde, and Sir Charles Metcalfe, well-known Labour leaders in Messrs. E. Bevin and J. H. Thomas, and experts in rural and local government questions in Messrs. Arthur Allen, Henry Hobhouse, and Leslie Scott.

In the present instance Dr. Addison laid before the chairmen a number of committee reports upon different aspects of the electric power supply question, and asked them to advise whether electric power should be generated on a national system, and, if so, whether energy should be supplied at a uniform rate for all areas, whether distribution should be nationally controlled, and, if so, to what extent, and what form of administrative machinery would be appropriate to a national system. The report is signed by Sir Henry Birchenough (President), Mr. Arthur Allen, Sir Clarendon Hyde, Sir Charles Metcalfe, and Mr. Leslie Scott; and Mr. Lionel Hichens attaches a dissentient memorandum.

The chairmen were strongly of opinion that electric power should be generated on a national system, but they took the point that the administrative system recommended by the Williamson Committee was too complex (particularly in regard to the methods of finance proposed) to operate with the celerity and uniformity necessary to take advantage of the opportunity of promoting a comprehensive system of electric power supply throughout the United Kingdom on the termination of the war. It seemed to them essential that the creation of large generating stations should be taken in hand at once, and that adequate provision for the development of backward areas, especially having regard to the desirability of increased use of electric power for agricultural purposes, should be made upon a national scale forthwith.

They accordingly came to the conclusion that any efficient system for the development of electrical generation and main-line transmission in the United Kingdom must not be only a national system, but a single unified system under State regulation, in the financing of which the State would participate on a large scale. It should, however, be framed and administered throughout upon a definitely commercial basis, and not in any sense upon Civil Service lines. They believed that upon this footing it should be possible to supply energy in different areas at rates highly favourable to consumers of power in comparison with present rates, and at the same time to provide for interest upon capital, and for renewals of plant and amortisation, and to allow of a balance being carried to a reserve fund.

Whilst fully sensible of the necessity of limiting to the utmost extent any further capital commitments of the State, the chairmen laid stress upon the vital importance of a full development of electric power for productive purposes. They pointed out that the development of such power in the United Kingdom was at present in its infancy, and that high authorities had estimated the loss incurred by the nation through failure to take full advantage of electrical progress at not less than £100,000,000 a year. On the other hand, the capital value at present invested in electric generation (as distinct from distributing) plant in the United Kingdom did not apparently exceed £45,000,000. Moreover, as most of this represented up-to-date plant, the dead-weight capital for the amortisation of which the State would have to provide on taking over all existing plant under a national scheme would not exceed £11,000,000.

The chairmen were therefore strongly in favour of the nationalisation of generating plant, and the working of such plant in all districts on a national system, though they recognised that it would not be commercially practicable to supply energy at a uniform rate in all areas.

As regards distribution, while holding that the State should control main transmission lines, the chairmen were of opinion that in many cases the Electricity Board (whose constitution is explained below, and who should have full discretion in the matter) would find it convenient to leave distribution in the hands of existing agencies, where such agencies were efficient and progressive.

They recommended that the Electricity Board should consist of six members, selected from men of proved business capacity and experience. The chairman should be appointed for a term of five years, and should receive an honorarium sufficient to attract the services of a first-class man, and the remaining members (certain of whom should retire annually) should receive the equivalent of directors' fees on a high scale. Adequate measures should be taken to preserve Parliamentary control over the financial operations of the Board, and regulations necessary to ensure that the undertaking was managed with due regard to the interests and requirements of the public should be made by the responsible Government Department.

The first duty of the Electricity Board would be to plan

out a comprehensive scheme for the whole country, and by degrees to secure the development of electric power over the whole of the United Kingdom by such methods as it might find suitable to the requirements of different areas.

In order to give effect to its schemes, it should be empowered to create an "Operating Executive," to which full executive authority and responsibility for the technical management of the scheme or schemes should be entrusted. The men appointed should have the highest qualifications from the technical and business points of view, with salaries (or salaries supplemented by commissions) appropriate to the necessary standard of practical experience. Proper capital, and profit and loss, accounts should be kept. The staff should be, in all its branches, organised upon commercial and not upon Civil Service lines. The Operating Executive would no doubt appoint a manager and staff for each area or central station, and it was to the emulation between these managers that they would look for that stimulating rivalry and competition which was generally absent from the undertakings of public bodies.

The chairmen concluded by saying:—"We are fully alive to the intricacies of the subject and to the practical difficulties of putting into operation any comprehensive scheme on the lines which we have indicated, but we think that these difficulties can, and will, be overcome by intelligent co-operation between the State authority and the various sections of the community concerned."

THE FUNCTIONS OF THE ENGINEER: HIS EDUCATION AND TRAINING.

At Edinburgh, on March 11th, the paper by Bt.-Lieut.-Col. W. A. J. O'Meara (an abstract of which appeared in our issue of February 21st) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Prof. Hudson Beare said a difficulty would be to find room for the proposed new classes in the already overcrowded curriculum of the young engineer. If the three years' term were extended to four years, other important branches could be introduced. He was doubtful if in a course covering 36 hours they could convey an adequate knowledge in the subjects specified by Col. O'Meara. In Edinburgh they hoped to do something in the way of lengthening the course through the establishment of a degree of commerce, which would include training in accountancy, business methods, administration, &c. As soon as the scheme got to work he would endeavour to get the Professor and Lecturer on Commerce to give a course to students who were going to be technical men, and who required a knowledge of the side branches of commercial work. That, of course, would necessitate the extension of the present three years' course. The young engineer should be made to realise that the extra subjects now proposed were not put in for window-dressing purposes. The engaging of young engineers without a premium did not affect Scotland, but in London the difficulty was to secure a start for lads fresh from college. He hoped there would soon be a remedy, and that firms would not insist on premiums for lads who had finished their curriculum. As to simultaneously working the practical and theoretical training, he thought they might have an arrangement for six months at the university in winter and six months at the workshops in summer, extending the training to five years, with half of it practical and half theoretical. The matter was one for discussion between professors of science and employers.

Capt. Scott Maxwell said the ratio of engineering students in the United States to population was higher than in this country, and when they came to the Continent the difference was more marked. The continental engineer had a much broader education than the British engineer, and in foreign competition higher respect was paid the continentally-trained man. While we led in the past, we might not lead in the future when the empirical method was of less value than the scientific. In America a man had a better technical training, though his general education might not be any better. Here the possession of a B.Sc. degree was often a handicap on a man asking for a job from an old-fashioned firm. Lads now training for the positions of "captains of industry" should in the first place take the Arts course, which in Scotland would start at 16. At 19 he would have taken his M.A. degree and have had a fair training in mathematics, chemistry, and other more or less important subjects, so that when he went up for the next three years for the B.Sc. he would be able to give most of his time to technical subjects. A poorer lad could be so educated if the training were arranged for six months at the university and six months at the workshop, with decent pay in the latter. It would be possible for a lad to help to support himself for at least half the year, and be in possession of two degrees, with three years' practical training, at 22. He would study commercial subjects in his Arts course, and in the Science course deal entirely with science and engineering. Another year's commercial course might be given, and, if possible, a year abroad. By the time that man was 30 he would be worth £2,000 a year to any fair-sized company.

Mr. Buchanan said the chief difficulty lay in the already overcrowded state of the usual college curriculum. His own experience had been that many students failed to do as well as they ought in certain classes from sheer inability to accumulate knowledge at a rate exceeding their own critical speed. In such a case the student commonly let one subject slide—it might be the very subject he was weakest in. He considered that there were serious objections to the inclusion of the new subjects in the college course unless the duration of the latter was extended. He protested most emphatically against the suggestion of curtailing the teaching of design, and he believed that Col. O'Meara took too narrow a view of the benefits to be derived from instruction in this subject. The engineer could not make full use of his technical knowledge unless he could reduce it to figures whenever the need arose. Ability to do this, and an almost fatherly understanding of the inner nature of his own particular kind of machinery or structure, were the things which were learned in a peculiar degree in the design class. He suggested that the necessary instruction in commercial subjects might be arranged during the term of apprenticeship or pupilage. He saw no serious reason why the management of the firm should object, and he believed that the weekly hour or two spent amongst different surroundings and mental atmosphere would be welcomed by the student. He also suggested that there was need for the improvement of the average engineering student's command of the English language.

Mr. J. W. Taylor agreed with Prof. Beare in suggesting the necessity of a conference between practical engineers and professors of engineering to find some solution of the training problem. This was a matter in which the Institution should take an active part.

Prof. Bailey, while not agreeing with all the proposals in the paper, pointed out that he would more willingly meet employers in conference if they had their own sons, and not their apprentices, in their minds. If it was the employers' sons' interests which were affected the matter might be more expeditiously settled.

Mr. A. Page concurred in the suggestion that business and commercial training should, if possible, be made to form part of the curriculum at the technical colleges, and the new Education Act might provide some channel along which this desire could be effected. There should be no slurring over of technical education, but they did not want a hybrid between an engineer and a chartered accountant. Engineers should have less suspicion and more frankness. He endorsed all Col. O'Meara had said with regard to general education.

Mr. D. S. Munro did not favour a longer course except for those whose abilities or ambitions impelled them to continue varied studies when their formal engineering training was completed. He noted that the author wisely stopped short without attempting to express (even as a negative quantity) the financial element in the modern workman.

Col. O'Meara, in reply, said he was not proposing that the subjects which he was suggesting should be taught in the wide sense some of the speakers seemed to think. He suggested that the principles only could be taught. He suggested curtailing some of the training in design, though he could understand there might be difficulties. He had found American engineers at Kimberley, and German engineers on Government work in Canada. He did not know the reason for the preference. He might have been wrong in concluding that it was due to the breadth or shallowness of our education. In the principles of administration and commercial subjects a start should be made at once. He thought the situation was one for compromise, and it was with compromise in view that he made the suggestions in the paper.

BRITISH CANALS.

In a report on the subject of canals, approved by the Main Transport Committee, the Federation of British Industries expresses the opinion that the report of the Royal Commission on Canals, issued in December, 1909, upon which no action has been taken by the Government, amply demonstrated the need for the unification and development of our inland waterway systems.

In France, Belgium, and Germany, as in England, in the period following the advent of the railway era, canals and waterways were for a long time neglected. With the exception of the Manchester Ship Canal and some improvements to the Aire and Calder and Trent Navigations, there had been no capital outlay upon canals in this country.

In 1879, however, France embarked on the improvement of 2,500 miles of river and 2,250 miles of canal, and the construction of 870 miles of new canals, at a cost of £28,000,000, out of which by 1900 £25,817,211 had been spent. Belgium between 1871 and 1900 spent £8,272,159.

In the opening years of this century in France a fresh programme was laid down at a cost of £8,242,800, all of which was spent before the outbreak of the great war, and other large schemes were initiated. It is useful to note that the canals and not the rivers of France carry the major part of her inland water traffic.

In Germany, by the law of April, 1905, an expenditure

of £16,738,750 was initiated on condition of local contributions.

With the report of the Royal Commission still awaiting the attention of Parliament, the Federation is of opinion that no further detailed investigation is necessary as a preliminary to the appointment of a Waterways Board, the appointment of which was the first step recommended by the Commission.

The cost of the acquisition of the system of canals known as "the Cross," with the smaller tributary canals adjacent, may, on the basis of 25 years' purchase of income, be taken at about £6,000,000, whilst the development of the main routes to the 100-ton standard was estimated at £17,533,910. Post-war figures would, however, be largely increased. Sir Maurice FitzMaurice, chairman of the Canal Control Committee, in his evidence before the Select Committee on Transport last autumn put the figure at £28,000,000 plus an approximate amount of £10,000,000 for the provision of facilities for dealing with the traffic.

After two years' experience of controlling all the principal canals save those railway-owned, Sir Maurice FitzMaurice's opinion confirmed the findings of the Royal Commission as to the absolute need for unification of management, improvement to permit of mechanical haulage, larger boats, increase of speed, and the freeing of those now in railway hands of that control.

Through the action of the Waterways Association, a very large number of typical local authorities have passed resolutions generally approving of the recommendations of the Royal Commission, and accepting the principle that, where the Government undertakes the improvement of a canal benefiting their area, they will contribute to the cost.

It is urged that steps should immediately be taken for development by sections where local authorities are prepared at once to shoulder a portion of the cost. If need for the development of waterways existed prior to the war, it is now an absolute necessity.

The immediate employment of labour necessary in the reconstruction of the canals would find just the kind of employment required whilst the industrial population changes from munition and other war work to the production of wealth.

The Federation is convinced that, under private ownership, improvements to our canals are impossible, and that their development by the State must be one of the first schemes in national reconstruction. Without this it will be impossible to meet new conditions upon equal terms in competition with countries already in possession of the cheap transport provided by inland waterways, whose Governments are already planning their further extension.

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1917, is taken from the recently-issued trade statistics. The figures for 1916 are added for purposes of comparison, and notes of any increases or decreases are given :—

	1916. £E.	1917. £E.	Inc. or dec. £E.
Electrical machinery.—			
From Great Britain ...	5,000	5,000	—
,, United States ...	—	3,000	+ 3,000
,, France	3,000	1,000	− 2,000
,, Italy	1,000	—	− 1,000
,, Switzerland ...	—	3,000	+ 3,000
Total	9,000	12,000	+ 3,000
Steam engines, including boilers, &c.—			
From Great Britain ...	32,000	20,000	− 12,000
,, Switzerland ...	3,000	—	− 3,000
,, United States ...	1,000	6,000	+ 5,000
,, France	2,000	—	− 2,000
,, Other countries ...	1,000	1,000	—
Total	39,000	27,000	− 12,000
Petrol and benzine motors.—			
From Great Britain	26,000	10,000	− 16,000
,, France	1,000	—	− 1,000
,, Italy	1,000	—	− 1,000
,, Switzerland ...	36,000	49,000	+ 13,000
,, Other countries ...	—	1,000	+ 1,000
Total	64,000	60,000	− 4,000
Copper, manufactured.—			
From Great Britain ...	7,000	10,000	+ 3,000
,, Germany	—	2,000	+ 2,000
,, United States ...	2,000	9,000	+ 7,000
,, France	6,000	1,000	− 5,000
,, Italy	1,000	—	− 1,000
,, Other countries ...	1,000	—	− 1,000
Total	17,000	22,000	+ 5,000
Lamps of all kinds.—			
From Great Britain ...	6,000	7,000	+ 1,000
,, Germany	1,000	—	− 1,000
,, France	6,000	9,000	+ 3,000
,, Italy	6,000	2,000	− 4,000
,, Holland	—	6,000	+ 6,000
,, Switzerland ...	—	4,000	+ 4,000
,, United States ...	—	1,000	+ 1,000
,, Japan	—	7,000	+ 7,000
,, Other countries ...	15,000	3,000	− 12,000
Total	34,000	39,000	+ 5,000
Scientific instruments.—			
From Great Britain ...	19,000	15,000	− 4,000
,, Germany	1,000	1,000	—
,, United States ...	4,000	4,000	—
,, France	11,000	4,000	− 7,000
,, Italy	3,000	—	− 3,000
,, Switzerland ...	1,000	—	− 1,000
,, Other countries ...	1,000	—	− 1,000
Total	40,000	24,000	− 16,000
Other machinery (except agricultural).—			
From Great Britain ...	48,000	37,000	− 11,000
,, United States ...	9,000	12,000	+ 3,000
,, France	13,000	11,000	− 2,000
,, Italy	3,000	4,000	+ 1,000
,, Switzerland ...	4,000	12,000	+ 8,000
,, Sweden	1,000	—	− 1,000
,, Holland	1,000	—	− 1,000
,, Other countries ...	2,000	3,000	+ 1,000
Total	81,000	79,000	− 2,000
Electric, telegraphic, and telephonic apparatus.—			
From Great Britain ...	45,000	18,000	− 27,000
,, Japan	1,000	1,000	—
,, United States ...	1,000	3,000	+ 2,000
,, France	16,000	7,000	− 9,000
,, Italy	15,000	16,000	+ 1,000
,, Sweden	4,000	2,000	− 2,000
,, Switzerland ...	4,000	3,000	− 1,000
,, Other countries ...	2,000	2,000	—
Total	88,000	52,000	− 36,000

£E = £1 0s. 6½d.

THE UTILISATION OF WATER-POWER ON THE RIVER DUERO.

[FROM OUR SPECIAL CORRESPONDENT IN SPAIN.]

The vast amount of water power available on the river Duero and its tributaries has been receiving the attention of engineers for some time past, and last year a company was inaugurated by several Bilbao capitalists to utilise at least a part of the 350,000 H.P. now running to waste. A capital of 150,000,000 (£6,000,000) was proposed, and the company was formed under the title of "Saltos del Duero." In view of the fact that the river forms the boundary between Spain and Portugal for over 60 miles, and this in situations where waterfalls are most abundant, it was found necessary to make the company international, and the promoters were successful in interesting the Portuguese Government, and also the Bank of Portugal.

The name of the undertaking has now been changed to "Sociedad Hispano-Portuguesa de Transportes Eléctricos," and it is proposed to supply electrical energy for lighting, power, and traction in both countries. It will be necessary, first, to construct a railway to bring building and other material to the various sites, and the company is trying to get under way at the earliest possible moment, in order to give employment to the many engineers and workmen who are at present unemployed throughout the peninsula.

As a beginning the company has now placed before the Ministerio de Fomento plans for the utilising of two falls on the River Tera, in the N.-W. region of the Province of Zamora, whereby some 26,000 H.P. can be harnessed. At these falls, Ribadelago Fall and Cobreros Fall, the flow of the river can be very simply and effectively regulated by utilising the natural lakes of Sanabria and Lacillo.

Ribadelago Fall.—A dam 3 metres high and 30 metres long, will be necessary, and also a canal 6,400 metres long, of which the greater part will be in tunnels through a mass of very hard granite. The penstock will be 2,400 metres long, and this also will be constructed within a tunnel cut through the granite.

Cobreros Fall—For the utilisation of this fall a dam 6 metres in height, and 40 metres long, is required. The proposed canal is 7 kilometres long, of which 2·5 kilometres are in tunnel, while the penstock will be placed within another tunnel 2·6 kilometres in length, piercing a rock of quartz and granite.

In its report to the Ministerio de Fomento, the company gives the following figures relating to the construction of the two power houses :—

	Ribadelago Fall.	Cobreros Fall.
Area of watershed in sq. kilometres	50	275
Average height of watershed above sea-level. Metres	1,800	1,700
Annual rainfall. Millimetres ...	1,800	1,800
Dam. Height above sea-level. Metres	1,650	1,026
Flow of water. Litres per second ...	2,000	12,000
Net head in metres	575	107
Power at turbine shaft. H.P. ...	12,700	14,000
Cost per H.P. developed. Pesetas ...	173	317
Power available, low-tension, at 50 km. from power house. H.P. ...	10,500	—
Power available, low-tension, at 65 km. from power house. H.P. ...	—	11,500
Cost per H.P. available. Pesetas ...	469	623

The distances given of 50 km. and 65 km. respectively refer to supply in the town of Ponferrada, but the company is contemplating supply to other towns in the Asturian mining district, as far as Oviedo, which is about 200 km. distant from the generating stations.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. I.

7,251. "Induction coils for radio-telegraphy or radio-telephony." F. J. Chambers. March 24th.

7,252. "Production of electrical oscillations." F. J. Chambers. March 24th.

7,271. "Telephone transmitters." S. G. Mason. March 24th.

7,278. "Electric choking coils." Alloy Welding Processes, Ltd., & E. H. Jones. March 24th.

7,287. "Ignition devices for internal-combustion engines." F. C. M. Cesbron. March 24th. (France, March 23rd, 1918.)

7,288. "Electromotor." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. March 24th.

7,289. "Electric relays for railway signalling apparatus, &c." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. March 24th.

7,292. "Controlling devices for electric starters for internal-combustion engines." F. J. Gill. March 24th.

7,294. "Automatic coin-operated telephone calling apparatus." T. M. Fletcher. March 24th.

7,316. "Swivelling brackets for mounting electric generators on aircraft." F. J. Hooper. March 24th.

7,323. "Electric heaters for apparatus for synthetic production of ammonia, &c." H. C. Greenwood & W. R. Tate. March 24th.

7,333. "Electrically-heated soldering bits." P. Marchiaro. March 24th.

7,336. "Electric lamps." L. S. Vello. March 24th. (Spain, March 23rd, 1918.)

7,343. "Electric lighting, heating, and ventilating systems for railway carriages, &c." H. D. Rohman. March 24th.

7,345. "Radio-oscillation generators." W. J. Mellersh-Jackson (A. Taylor). March 24th.

7,370. "Electric arc welding." A. Smith. March 25th.

7,408. "Pedestal for tramcar trolleys." T. H. J. Thomas. March 25th.

7,419. "Joints for sparking plugs, &c." C. Plattier & D. Zimmerman. March 25th.

7,456/7. "Telegraphic receiving apparatus." F. G. Creed & Creed & Co. March 25th.

7,460. "Electrolyte for copper deposition." J. F. Bates & T. F. Newman. March 25th.

7,464. "Means for controlling searchlights from distant station." P. W. Willans. March 25th.

7,478. "Means for ensuring ignition of working charges and preventing carbonising of sparking plugs of internal-combustion engines." Autoniters, Ltd., F. W. Hudlass & H. D. Smith. March 25th.

7,498. "Radio-telegraphic transmission systems." W. J. Mellersh (A. Taylor). March 25th.

7,501. "Automatic switching apparatus for telephone exchange systems." Western Electric Co. March 25th.

7,504. "Tramcar trolley heads." R. Heywood & S. Smith. March 26th.

7,537. "Ignition devices for internal-combustion engines, &c." W. Pickard. March 26th.

7,545. "Electric heating apparatus." C. H. Archer & Automatic Telephone Manufacturing Co. March 26th.

7,557. "Electric signalling systems." H. Green. March 26th.

7,578. "Non-acid mixture for charging accumulator cells." E. T. Grove. March 26th.

7,583. "Regenerative control of electrically-propelled vehicles or trains." A. Raworth. March 26th.

7,598. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 26th.

7,606. "Cooling high-speed dynamo-electric machines." M. Gruber. March 26th.

7,620. "Coils for electromagnets." British Westinghouse Electric and Manufacturing Co. & H. N. Cunliffe. March 26th.

7,624. "Magneto-electric generators." S. G. Brown. March 26th.

7,632. "Automatic reversing and stopping contrivances for electric motors." Soc. Anon. des Etablissements L. Bleriot. March 26th. (France, December 13th, 1918.)

7,642. "Telegraphy." E. S. Heurtley. March 27th.

7,650. "Electrically-driven vehicles." H. J. Carey. March 27th.

7,672. "Sparking plugs." F. W. Baker. March 27th.

7,675. "Device for taking X-ray, &c., photographs." W. C. Oram. March 27th.

7,685. "Alternators." M. W. W. MacKie. March 27th.

7,704. "Railway signal operating and controlling apparatus." McKenzie, Holland & Westinghouse Power Signal Co. & E. H. Peter. March 27th.

7,705. "Railway signal operating and controlling apparatus." McKenzie, Holland & Westinghouse Power Signal Co. March 27th.

7,722. "Electric arc apparatus for generation of oscillating currents." W. S. Entwistle. March 27th.

7,727. "Grainwood poles, &c., for electrical purposes, &c." H. Nobs. March 27th. (Switzerland, March 27th, 1918.)

7,749. "X-ray apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 27th.

7,763. "Electric lamps." J. H. Hall. March 28th.

7,781. "Electrically-driven rotary pumps." J. W. W. Drysdale, Drysdale & Co., & J. Young. March 28th.

7,795. "Sparking plugs for internal-combustion engines." A. V. Terry and H. Terry & Sons. March 28th.

7,799. "Trolley heads for electric tramcars, &c." S. K. Kirkland & H. R. Tidswell. March 28th.

7,804. "Spark plugs for internal-combustion engines." S. Fisher & W. Priddey. March 28th.

7,806. "Electric motors for continuous current." A. F. Bazan. March 28th.

7,815. "Diaphragms for sound boxes for gramophones, telephones, &c." A. T. Collier. March 28th.

7,830. "Quartz mercury-vapour lamps." H. George. March 28th. (France, April 24th, 1918.)

7,831. "Telephone systems." T. Pettigrew and Siemens Bros. & Co. March 28th.

7,833. "System of electric power distribution for trains." P. Dawe. March 28th.

7,841. "Mercury lamps." H. George. March 28th. (France, August 8th, 1918.)

7,848. "Electromagnetic separation or concentration of minerals." W. M. Mordey. March 28th.

7,851. "Electron discharge apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 28th.

7,862. "Regulating device for maintaining constant voltage in dynamos working with great variations of output." L. Rouzet. March 28th.

7,879. "Electric switches." S. W. Hamlyn. March 28th.

7,895. "Electrical condensers." G. F. Mansbridge. March 29th.

7,904. "Method of changing frequency or alternating currents." F. S. Carter. March 29th.

7,906. "Magneto machines for internal-combustion engines." C. Greenald. March 29th.

7,960. "Manufacturing electric incandescent lamps, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

9,912. Reception and transmission of sound or compressional waves. Brown. July 7th, 1915.

11,333. Marine signalling apparatus. Allen. August 5th, 1915.

12,869. Microphonic sound and vibration detectors. Western Electric Co. & Nash. September 8th, 1915.

13,973. Sound detecting and measuring systems. Western Electric Co. and Nash. October 2nd, 1915.

1918.

1,387. Ignition systems for internal-combustion engines. Splitdorf Electrical Co. May 18th, 1917. (116,492.)

3,670. Electric fuses. F. A. Ross. March 2nd, 1918. (123,807.)

3,846. Electric switching devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 5th, 1918. (123,812.)

3,848. Electric switches. F. B. Holt & British Westinghouse Electric and Manufacturing Co. March 5th, 1918. (123,813.)

4,073. Sparking plug. C. R. de Tassigny & J. Puerto. March 17th, 1917. (115,809.)

4,428. Control of electric furnaces. W. J. Howard. March 13th, 1918. (123,845.)

6,327. Signal device for motor vehicles. Benjamin Electric Co. June 18th, 1917. (116,883.)

6,562. Gas or electric cookers and solid-fuel or refuse burning stoves adapted to be used in combination. E. J. Jenkins & A. S. Smith. April 18th, 1918. (123,878.)

6,910. Vents for electric accumulators and batteries. H. Ramsbottom and Lithanode, Ltd. April 24th, 1918. (123,882.)

9,021. Windings in electrical apparatus. Brush Electrical Engineering Co. & P. W. Schonfield. May 31st, 1918. (123,906.)

10,674. Sparking plugs for internal-combustion engines. B. Hoppe, A. M. Lodge & Lodge Sparking Plug Co. June 28th, 1918. (123,917.)

12,490. Electrical internal tube heaters. H. Gutzwiller. August 8th, 1917. (118,615.)

16,819. Electric controllers. R. W. James (R. W. Stanley). October 15th, 1918. (123,939.)

18,585. Dynamo-electric machines. British Westinghouse Electric & Manufacturing Co. November 23rd, 1917. (120,911.)

20,605. Apparatus for the electrical protection against corrosion, pitting, and the like of the tubes, ferrules, doors, and other parts of surface condensers and the like. L. J. Kettle. December 11th, 1918. (123,961.)

1919.

2,507. Manufacture of electric accumulators. H. Leitner & W. H. Exley. March 14th, 1918. (Divided application on 4,530/18.) (123,969.)

Electric Smelting in British Columbia.—Dr. Stansfield, of McGill University, has prepared a report on the commercial feasibility of electric smelting of iron ores in British Columbia. He considers that smelting is metallurgically feasible, there being sufficient supplies of ore and of the requisite fluxes for carrying out the process. The present cost of electric power, however, makes the profitable production of pig-iron impossible. The ores are chiefly magnetites, and contain 50 per cent. to 55 per cent. Fe., are practically free from phosphorus, titanium, and copper, and the proportion of sulphur could be kept as low as 0·1 per cent. Although British Columbia has ample water supplies which could be harnessed, this would take a long time to carry out. The author considers the possibility of utilising the surplus power supplies of local electric railways, and points out the abundant supply of timber at hand from which charcoal for the electric smelting could be easily obtained.—*Engineering and Mining Journal.*